A Compendium of Chemistry:

Historical Theoretical and Practical.

Being

the substance of a Course of

Chemical Lectures;

Delivered by John Morgan, Professor of Medicine in Philadelphia. in the year 1766.

John Hodge

The main business of natural philosophy is to argue from phaenomena without feigning hypotheses.

Newton.

× the most probable derivation of chemistry is from the word Hamut wch signifies in the oriental Language ovum Keller

History of Chemistry.

Chemistry, according to the modern acceptation of the name, is a very extensive & useful branch of natural & experimental Philosophy.

The first author with whom this word is found is Plutarch who lived under the Emperors Domitian Nerva and Trajan, according to him the word signifies black, others will have it originally denotes secret or occult and derive it from the Hebrew Chamar or Hamar, but the learned Bochart chuses to derive it from the Arabic Chema or Kema to hide. The first time Chemia or Chemistry occurs as denoting the Art we are speaking of, is in a Greek Manuscript of Zozimus the Panopolitan preserved in the Kings Library at Paris; this Zozimus lived under the younger Theodosius about 400 years after the Christian æra or at least near the begining of the fifth Century.

The

The place where Chemistry had its origin is uncertain and has been warmly disputed by Borrichius and that monster of erudition Conringius. Borrichius thinks it was invented by the famous Egyptian philosopher Hermes Trismegistus; while Conringius imagines it to have been of more modern date & invented by the Greeks.

Chemistry as now received is an assemblage of very different parts which anciently subsisted separately, as the preparing of metals for human uses or Metallurgy; Alchemy, Pharmaceutic & Philosophic Chemistry; the aras of which are different.

Metallurgy chalenges the highest antiquity, and is no doubt of a very early standing. To find, procure, fuse, refine & render malleable, and apply metals to use is all of Antidiluvian invention, and was attri-

attributed by the antients to their Gods.
Moses the oldest author now extant in his
genealogy of the Patriarchs relates, that
Tubalcain, the eighth from Adam was
an instructor of every artificer in Brass
and Iron to prepare the utensils and
Instruments of life. Now, it is apparent,
that nothing of this could be effected,
without a thorough acquaintance with
the metallurgic Art. This account of Moses
is surprisingly seconded, and confirmed, by
prophane history and fable, the Hpaistos
of the Egyptians and Greeks, and the
Vulcan of the Romans and Sattins, whom
they say invented the forging of Metals,
being the same with the Tubalcain of
the Hebrews, as is proved from many
very evident circumstances.

Immediately after the flood we find that Noah made Wine and was thereby intoxicated; the making of which is a chemical process.

It is very reasonable to suppose that this branch of chemistry was known among the Egyptians; in Exodus 32 we find that the children of Israel made a golden Calf, and, that when Moses saw it, he burnt it, ground it to powder, and mixed it with water, which is a very nice chemical process, and in Acts 7. it is said, that Moses was learned in all the wisdom of the Egyptians; but we no where find that chemistry was here, or in any other place in these early ages practised as a science; therefore let us now look among the Greeks who recieved their Arts

× We find two principle objects of their speculation wch some have often been canvased by the ingenious The first was "what were the Elements of bodies? The other on what the qualities of bodies depended?

Thales this scholar Anaximander gave it as their opinion concerning the former that it was water. Anaximenes a succeeding learned Greek said Air was the primary Element. Heraclitus was of opinion that fire was the only Element of bodies whilst Pythagoras & his sect & the Stoics were more liberal admiring the Elements of bodies four Fire, Air Earth & water

The Greeks in solving the 2d question viz: on wch + the qualities of bodies depended, very much discented from each other some asserted that they depended on certain innate principles wch they called substantial forms Epicurus Leucippus & Democritus wth their follower

Arts and sciences from Egypt, and here we shall find little of chemistry invented, or practised: most of the Greek philosophers delighting more in nice speculations and fine spun Theories than experiments and useful observations, in many of which however they greatly disagreed; particularly in the principles of which bodies are composed of, some supposing of fire, others Air and Earth, others Spirit, Water, Bile and black bile; while others supposed them to be compos'd of Air, Water, Earth and Fire, a system still embraced: and others again of Atoms variously combined. Boyle, Descartes, Bacon, Newton, and others have embraced this Hypothesis, which now goes by the name of the Atomic or corpuscular philoso-

phy

endeavored to prove, that on the arrangement,
not the innate principles of the last atoms of
bodies their properties depended. from whence the
got title of corpuscular Doctrine &c

=phy and is generally received.

From Greece we will pass into Italy, and examine the Romans who received their learning from the Greeks; this nation being a warlike people paid little regard to the more polite Arts and Sciences. till about four Hundred years after the building of Rome, having conquered the nations around peace & plenty abounding, luxury and effeminacy began to prevail, at which time various Arts & Sciences, among which was Chem=istry, was introduced among them, being necessary to politeness; the first that wrote of Philosophy among them was Lucre=tius who followed the opinion of Epi=curus and Empedocles; but chemistry was not cultivated by the Romans as a science but only as mechanical.

The Arabians were a barbarous and ignorant people till about the ninth century, when having subdued Egypt, and many of the Greek writings falling into their hands, they translated and commented upon them: especially those wch treated of Physic, and were the first that invented Pharmaceutic Chemistry.

It is proper to divide Chemistry into four parts according as they took their rise at different times viz. Metallurgy, Alchemy medical or pharmaceutic and philosophic Chemistry. Metallurgy we have already proved to be of early standing and even known to the antediluvians.

Alchemy we have many Books upon: some pretended to be the works of the antient Egyptians, and Greeks. but it is evident

they

they are all of later date and were wrote about the twelfth thirteenth and fourteenth centuries, consisting of idle Enigmatic stories, wholly chimerical and unworthy the perusal of any man; however Alchemy has been of service to chemistry, for many prompted with the desire of excelling & vainly imagining, that there is such a thing in nature or attainable by Art as the philosophers stone, a universal Medicine &c: in their searches after them have discovered many things of the greatest importance to chemistry.

The Arabians gave it the name of Alchemy by affixing after the manner of their language the particle Al. to the Egyptian name to heighten the credit of Art. This era may be fixed at about four hundred years after Christ. The first that mentions Alchemy is Zosimus Panopolitanus a Greek who lived near the

the end of the fifth century, but Alchemy as it aims at an universal remedy was first introduced by Paracelsus tho' it is highly probable, that it was the Arab Geber occasioned people to turn their tho'ts that way, by saying he knew of a medicine that would cure all lepers and all diseases.

It seems very evident from what has been said that Alchemy gave rise to Pharmaceutic Chemistry, for failing in their attempts after an universal remedy, they often met with the happy success of a very useful medicine in the practice of physic,

The introduction of Pharmacy is partly owing to Galen, for after the discoveries of medicine every thing was crouded into the Materia Medica without any order or regulation and greatly increased by the scholars of Hippocrates

× and the vast variety of Arabian names that were introduced into chemistry as Alembic Athenor, Alkali Alkohol &c

Hippocrates and in the school of Alexandria, some of the pharmaceutical preparations of those early ages though a disgrace to medicine have ever since till of late been retained, and at present by some are still retained as the Theriac Mithridate &c: many other of their compositions may be seen in Scribonius Largus.

Pharmaceutic Chemistry was first known among the Arabians, as is proved: first, by the antient chemists in Europe referring to Geber & Rhazes as the oldest authors, had there been any Greeks before them they certainly would have known it. 2d. by their being the first that introduced any substance chemicaly prepared into Medicine. 3. by their discoveries of new bodies as Nitre &c: and lastly by their writings

Writings in which several chemical preparations are fairly described.

It was about the twelfth century that Rhazes introduced the chemical Pharmacy after which the Galenic began to decline. and the bulk of formula to lessen, by extr= acting the active principle from bodies for the use of medicine; but we are more par= ticularly indebted to Paracelsus for the foundation of pharmaceutic Chemistry, he was born in 1493 his father was a Physician and initiated to the secret of the chemists in which he brought up his son, he traveled into many places, by which means he found out the use of Opium Antimony & Mercury with which he began practice and after afterwards made professor at Basil but was soon obliged to decline the same and offending the magistrates he

x In 1792 the College of Edinburgh published their
Pharmacopoeia Edinburgensis.

He was banished Switzerland, and after travelling up and down for some time he died in 1543. he wrote on Alchemy Palmistry Magic &c: the Paracelsian or chemists opposed the Galenists, however the galenical Pharmacy subsisted separate for 1300 years when Brasavola and others joined it with the chemical, whence the conjunction thereof in the present Pharmacy; the chemical Pharmacy about the latter end of the last century was carried to a very high degree of honour, D: Ludovicus Bates &c: are examples, and public persons were appointed to prepare the compositions, hence arose the business of Apothecaries, there being likewise occasion for some public & certain manner of compounding medicines, public Dispensatories were therefor compiled.

The

× In the Codex Medicamentarius published at Paris 1749 there are many absurd compositions

The best Dispensatory now in print is that of London of 1746 and we hear the college of Physicians at Edinburgh is now compiling a dispensatory if possible to surpass that of London for simplicity: the exweeden Dispensatory is reckoned to exceed that of France, & Italy for its simplicity: hence it appears that the present improvements in the chemical Pharmacy far exceed, that introduced by Paracelsus, for instead of compounds, we have now simples — instead of many few destilled waters — instead of extracts we have infusions — instead of many destilled oils but a few, as all destilled oils are similar in virtue — instead of the many vegetable essential salts few or none do salt of Tartar or potash is equal thereto in all intents. — Copper and

x he held that many diseases were occasioned by effervescences, fermentations & all other operations that Chemistry employs, but his doctrine became at length so ridiculous that now it is only laughed at & banished from sober Philosophy

"And like the baseless fabric of a vision
Left not a wreck behind."

and Silver as too corrosive, and Lead &
Tin as too astringent, except in external applic-
ications are almost exploded, together with
many other useful alterations made therein.

Having done with Pharmaceutick Chemistry
the philosophic part is lastly to be considered;
this appears never to have existed among the
Arabians or Greeks, Chemistry matter hav-
ing been applyed to philosophy till the
appearance of Paracelsus who applyed
it to the Theory of Physic holding that
tartar obstructs the Vessels &c.[x] another
Chemical Theory was afterwards introduced
by Van Helmont who was born in the
year 1577 of a noble family and leaving
the Galenic system he embraced the Para-
celsian, or rather introduced one of his own:
holding an Archeus or universal spirit
as the principle of all bodies, he

x Wesper cases the Archeus of Helmont Praises

he was in some measure followed by
Wepfer Stahl & others, the latter called the
Archeus by the name of the anima medica:
thus we see that the most learned and
judicious men have been misled by these
false chemical Theories.

Des Cartes founded a theory of Phi-
losophy, and as a theory built entirely
upon speculation, without any evident de-
monstration, it was soon exploded and is
now scarcely ever mentioned but by way
of ridicule. he ascribed the causes of
diseases to effervescence & Fermentation
&c: reckoning Acids and Alkalis as their
procatartick cause. But the time is near
at hand when a true Philosophy is to ap-
pear, Bacon and Galileo the former apply-
ing to Chemistry the latter to Mathematics

first

first began the vame. we first hear of Bacon at Oxford in the year 1226 a fellow of the college, his cell is there vat Oxford to this day and there is a tradition that it will fall whenever a greater man than Bacon enters it.

Borelli, Bohna, but particularly the great Pitcairn introduced a mechanical theory of Physic. explaining the causes of all diseases by Mechanics, which tho seemingly nice and exact is nevertheless precarious, and often erroneous as were all the preceeding Theories, and there never appeared a compleat theory of Physic founded on the structure and nature of the human body untill that of the great Boerhaave. The great Boyle who history informs us was born the same

day

Becher said a man each day pisses now against the wall than enough to maintain him a week — proposed to convert the Sand of the Danube into Gold.

x de re metallicâ)

* In his tract called Aurea subterranea

" Kunckel is the inventor of the Phosphorus of urine he has likewise given us a workon Glass

Becher wrote a book called Physica sub=terranea

day that Bacon died, he greatly im=
=proved Philosophy, and is the first to
whom we are indebted, for true philosoph=
=ical Chemistry and the application thereof
to medicine; he declares he recieved more
instruction from the shops of mechanics
than from all the writings of his predec=
=essors: he kept up a regular correspondance
with all the noted chemists in Europe,
and with Sir Isaac Newton; the sanction
his works recieved from that great man
occasioned them to be more readily recieved,
and applauded, by every one. and there
is no authors worth reading before him
except Agricola and Lazerus Erchens.*
Glauber ~~and~~ Knuchel & Becker. enriched
Chemistry by their discoveries & improvments; (they were cotemp.ys of Mr. Boyle)
after these, more chemistry was improved by
means

× he was a german by birth but lived mostly in France.

The elder of these is famous for being the first who invented the Table of affinities of Bodies —

Neuman of Berlin uncom.d for having enriched pharmaceutical Chimistry

(D.r Pott good. Cramer very perspicuous the most valueable facts of german chemistry are in the Berlin memoirs.

means of Societies the first was that of the Royal Society at London, among whom was Shaw, Lewis, & Hill whatever they are an honour to their society, but the French have exceeded the English in their improvement of this science; Homberg* was a good chemist, he held that Acids were sharp pointed needles and Alcalis spungy, hence their affinity, and the cause why alcalis blunt the asperity of Acids by receiving their sharp points into its spungy pervious body. after him was the two Lemery's and Geoffroy's† and many others viz: Reamer on Iron; Duhamel on Vegetation; Hellot on Metallurgy &c. In Germany were Stahl, Juncker, Hoffman, Kinkle, and Margraaff. and in Sweeden there are not to Berlin but him in Swedish language we at present but little better for them

Marggraaff was the best German chemist next to him are the Swedes; Lewis is the best English chemist, and Macquer the best in France and far superior to them all or any of the preceding chemists.

Thus the history of Chemistry is ended, which, as a science appears to be the most modern of any, as scarce existing before the middle of the last century.

*These Agents are Fire, Air, Earth, Water, and particular menstrua.

Theory of Chemistry

Chap. I. Of Chemistry: its principles, Objects &c.

The whole Art of Chemistry may be comprehended under the skill of resolving bodies into their principles, by means of proper Agents, & of constituting new compounds from those principles: so that the one may properly be distinguished by analytical, the other by synthetical Chemistry: the former reduces bodies to their component matters, the latter puts these component matters together in various manners, & thereby forms a large set of new productions that would be absolutely indiscernable in nature, without the interposition of this Art, as for instance brandy, soap, Glass, Vitriol &c:.

Chemistry is not only of the greatest service in medicine, but also in Physics: for as Sir Isaac Newton demonstrates the laws & forces of bodies, as known by their effects

x The application of chemistry to a great number of important arts & trades must appear to every intelligent person in such a light as will not only lay a foundation of improvement but may lead to the investigation of new ones.

effects, all from Chemistry: and when he applies those forces to the explication of phaenomena he does it all by the help of Chemistry; which is a clear proof that without this Art, the nature & property of single bodies could never have been known by the most sagacious mortal.* For Chemistry skilfully applied may be said to be the parent of numberless branches of Art.

We should carefully distinguish between a mechanical and a Chemical operation which are very different e.g. If piece of metal by a mechanical operation be differently shaped; the operation is mechanical but if the same or a like piece of metal be changed by means of Fire, or Acids, Fermentation &: it is chemical. For any change wrought in the figure of a body by means of another body is mechanical: but if a change be

* If a bar of Iron be wrought into any figure by means of heat & hammer or made into any Instrum.† or Utensil the operation is mechanical, but if Iron by means of an Acid be turned into Vitriol it is chemical.

The properties of a knife or Wedge arising from its particular figure is a mechanical consideration, but if we consider the Iron matter it now put forth the uses these than other by being capable of being made very sharp, firm, &c. these are chemical — from hence we easily understand the Bounds between these 2 branches of Science —

* Lemertus defines chemistry to be "the art of preparing medicines & transmuting of metals" — very inaccurate —

Hoffmans definition is "the art of compounding or resolving bodies by fire — this very inadequate —

Boerhaave in his Method: Stud: Med: part 5 Chap: 1 — gives a very good definition of chemistry as follows,

Chemistry is that part of natural philosophy w. treats of the particular properties of Bodies (in opposition to gen. properties) & that operations their affects & thus easily distinguish'd from the mechanical branch of philosophy

the principles of
be wrought on any substance only
in consequence of the particular opera-
tion of bodies it is chemical; as for instance,
if sand and lime be put in water & stirred
together, the sand in consequence of its
specific gravity being greater than that
of the lime will fall to the bottom first;
this is a mechanical operation agreeing
with the laws of gravity: but if sand and
chalk be mixed together & an acid be joined
therewith, it will immediately change
the chalk into a neutral salt; this opera-
tion is chemical, as not to be accounted for
by any of the laws of mechanics.

Philosophic Chemistry is defined by
Shaw, an art of dividing & resolving all
bodies in our power, by means of all the
instruments that can be procured, and
that

* This is called the synthetical method, but the analytical is far preferable

that as well into integrant as into constituent parts, and joining these parts together again, so as to discover the principles, relations, and changes of bodies, make various mixtures & compositions, find out the physical causes of physical effects: & hence improve the state of natural knowledge, and the Arts depending upon it.

Some treat of chemistry by explaining the causes & effects of bodies simple & compound as if known à priori, but this is a very improper method, neither is that method sufficient which reduces all bodies under the Animal, Vegetable, & mineral kingdoms; but the best method yet known of arranging all chemical bodies is, under the following classes, according to the manner of D. Cullen of Edin

The Scenic of chemistry may properly be divided into three parts, the first is employed in the Explanation of the Terms of Art, the 2d. Treats of the operations of chemistry & the 3d. is occupied in delivering the chemical history of bodies.

*To illustrate this we are to suppose water to be an element & therefore a simple body, now if several parcels of water be mixed together the result will be a simple body still, as being only an aggregate of similar parts; but if water & earth &c. should be mixed together the result would be a compound body or an aggregate of dissimilar parts.

x Such particles of matter as are not divisible or changeable by any of the powers in the system of nature are called Atoms.

The simplest parts into which the utmost efforts of chemical Science can divide separate them from one another bodies are called chemical Elements. they are established 1st. by nature 2d. by Art

Edinburgh viz. Saline, inflamable, Metalic, Earthy, Watery, and Aereal. & this is the Method I shall pursue; explaining first the Terms. 2dly the Operations & 3. the History of Bodies.

The first general consideration of bodies is wether they are simple or compound, single or collected

Simple bodies are the elements themselves; compound bodies are several elements, joined together, of dissimilar parts.

Elements are either Physical or Chemical.

Physical Elements are Atoms exceedingly small & invisible, as is evident from the effluvia of Musk, Asa foetida, &c; which will soon fill a room without deminishing their weight. That those Atoms must

× Whatever mathematicians may say of matter being divisible ad infinitum I think it has no real foundation in nature; it is true we have instances of the great minuteness of particles or the exceeding divisibility of bodies as in the effluvia of a Rose, the emetic quality of antimony but yet the divisibility of bodies by the strongest endeavours of chemistry is finite as by means of that science bodies may be resolved into such principles as are altogether immutable by its utmost efforts.

From what has been said we may easily conceive what is meant by the Atoms of Democrates the monades of Leon & the hyladeæ of others, or the hylarchic principles & the last principles of bodies of almost all philosophers —

must be exceeding small when so
great a number of them as fill a room
scarcely or not at all diminish the weight
of the body from which they are expelled.

x From the preceeding consideration some
have imagined that these Atoms decrease
ad infinitum, but it seems most proper
to suppose, there is a determinate smallness
of them; and that they decrease only ad
definitum.

Mr. Boyle tells us that having exposed
to the open Air a certain quantity of
Asafoetida, he found its weight diminished
only the eighth part of a grain in six
hours; Hence if we suppose that during
all that time a man could smell the asa-
foetida at the distance of five feet, it will
appear that the atoms of its effluvia cannot
exceed

exceed the $\frac{1}{2625000000000000}$ part of an Inch in magnitude.

These corpuscles or Atoms which are conceived as the first principles or component parts of all physical magnitude are supposed indivisible, not on acct of their want of extension (for they have the three demensions of physical magnitude) but on account of their solidity, hardness, and impenitrability which leave no vacancy for the admission of any foreign force to separate or disunite them, and consequently exclude a division. Thus it is necessary they should be indissolvable in order to their being the pre existent matter of which bodies were made. Sir Isaac Newton adds that it is required they should be immutable in order to the worlds continueing in

in the same state, and bodies being of the same nature now as formerly: from which consideration the antients were led to assert the eternity of Atoms as whatever is immutable must be eternal.

The principles of the Atomic or corpuscular hypothesis as it now flourishes in the mechanical philosophy, as summed up by Mr. Boyle are 1.st That there is but one catholic or universal matter which is an extended impenetrable & divisible substance common to all bodies & capable of all forms. 2.d That this matter in order to form the vast variety of natural bodies must have motion to some or all its assignable parts: and that this motion was given to matter by God, the creator of all things, and has all manner of directions, and tend=

Tendancies. 3. That matter must also be actually divided into parts, and each of these primitive particles, fragments or atoms of matter must have its proper magnitude or size, as also its peculiar figure or shape. 4th That these different sized or shaped particles may have as different orders & positions, whence great variety may arise in the composition of bodies.

The immutibility of matter is supported by supposing the atoms of bodies annihilated or gone to subsist in others thence springing up of the same kind. e.g. a Rose grows up, flowers, & then withers away, the particles of which are dissipated into the Air, these Atoms, perhaps the next year, coming in contact with a Rose in embryo, joins thereto in order to increase the

* The objects of chemistry are all corporeal substances of whatever kind – these are either Elements* or mixts.

Chemical Elements are sometimes called Principles.

Chemical mixts are dissimilar Elements combined. Thus acids which are made up of salt and water are mixts.

If two glasses of water wch are supposed to be made up of similar Atoms be added together they make an aggregate.

x Thus if an Acid & an Alkali which are both reckoned as mixts separately be united they make a compound.

The parts of an aggregate are generally looked upon as homogeneous or bodies as heterogeneous.

* The substances wch cannt be further resolved into others may & are by the chemists termd primary parts & the substances compos'd of these first Elements are cacd secondary principles.

the growth of the same; thus what exists today may be said to have existed a thousand years ago. This is the sum of the corpuscular doctrine & tome appears highly probable. - *

Chemical Elements are aggregates of similar physical Atoms as are compound bodies of dissimilar Atoms united, for aggregates are similar Atoms added together; A mixt is dissimilar aggregates united. A compound is mixts joined; A decompound is compounds united; A superdecompound is decompounds united &c.

There are two capital ways wherein Chemistry divides its objects viz: into integrant parts, and into constituent parts.

By integrant parts we understand, similar parts, or parts of the same nature with the whole, as filings of Iron have the same nature and

* The reduction of bodies into integrant parts is called division & into constituent parts resolution.

x In order to account for the variety in the nature & properties of bodies we must suppose that there are different kinds of atoms or constituent particles otherwise would not all bodies be the same as made up of the same atoms.[2] or else the differences in natural bodies must be owing to the different manner of union or mode of aggregation in the constituent particles or atoms of the same

Compound bodies are made up of an aggregate of particles that have interstices between them so that a compound body or mass is partly body & partly space which the more it is resolved the more solid it is, hence fire separates the parts of a body by entering its pores & forcing the particles asunder & not by penetrating the atoms or constituent particles themselves.

* ~~and~~ properties as bars of Iron. And by constituent parts we mean, dissimilar parts, or parts of a different nature from the whole; as when artificial cinnabar is divided into the quicksilver & sulphur.

x The different properties & dispositions of bodies is supposed to arise from the different modes of aggregation in the constituent particles thereof: thus Water in its fluid state has a particular disposition in its particles of receeding from each other, but when congeal'd they are not so: this is supposed to proceed from the particular mode of aggregation in its particles.

Of the Definition of bodies.

Salt is vapid to the taste, soluble in water, and not inflamable.

Inflamable bodies are such as can be set on fire & continue so when the fire is removed from them & also continue the flame

to

* Inflamation ought carefully to be distinguished from Ignition, the former is known from the latter in continuing burning when removed from the fire where as the latter begins to cool immediately after being removed from the contact of burning fuel.

x Mercury is fluid like water but differs therefrom in being opaque & requiring a much greater degree of cold to congeal it. vee page 66.

to all of the same quality that are in contact with them. *

Metals are opaque bodies, of great specific gravity, uninflamable, not soluble in water, but fusible in the fire & when drawn from thence concrete again into the same form as before.

Earths are solid, not soluble in Water, not inflamable, & scarcely fusible; but when so they vitrify. †

Water is a transparent body insipid not inflamable & cui generis concretes in a certain degree of cold. ‡

Air cui generis is a transparent imperceptable & elastic body.

Salts are either simple or compound simple salts are two Acids & Alcalies. Acids are commonly reckoned 4. viz Vitriolic Nitrous, Muriatic & Vegetable; their general properties

* It is necessary in all saline compounds bodies that an acid be one of its constituents parts.

properties are; they are saline bodies, of a sour taste, & added to syrup of violets changes it of a red colour.

Alkalies are simple saline bodies, w.ch have a pungent taste, producing an effervescence with Acids, & when added to the syr.p of violets changes it of a green colour.

Alkalies are either fixed or volatile.

Compound salts are neutral, metalic, or Earthy, neutral salts are composed of an Acid & Alcali, metalic salts of Acids & Metal & earthy salts of an Acid & an Earth.

There are generally reckoned three forms of inflamable bodies viz. Oils, Sulphur, & Ardent spirits: to w.ch chemists add a fourth called Phlogiston, which they believe to be the inflamable quality of bodies.

Oils are either Vegetable, Animal or Mineral.

X Wax is a particular substance collected by Bees
& may be ranked a solid Oil
Ether belongs to oils it is an Oil & Alcohol combin.

Vegetable Oils are Expressed Essential or Empyreumatic. under expressed oils are ranked, fats or Animal Oils; & Balsams, Resins, &c. are ranked under Essential Oils × the properties of Empyreumatic Oils are all the same.

Fossil Oils have all the same principles with some foreign matter combined therewith; the purest is Naphtha, next Petroleum, Asphaltum &

Sulphur mineralis, is a fossile substance, hard, & never found pure.

Ardent spirits, are an inflamable spirit mixed with water, the purest inflamable spirit is Alcohol. Ether is inflamable & akin to spirits but not mixable with water.

Metallic substances are Metals and

× It is said that in some late experiments made at Petersburg with very intense degrees of artificial cold (produced by mixing snow & Spirit of Nitre separately brought to great coldness) pure Mercury congealed into a silver like metal &c. quickly melted again on an abatement of the cold: & that in Farenheits Thermometer it sunk before its congelation to between 38 & 40 divisions below 0, that is about as far below the point at wch water freezes as the heat in which Tin melts is above it

Lewis's MM, note in p. 84

and Semimetals. Metals are either noble & perfect, as Gold & Silver: or ignoble & imperfect, as Lead Iron Copper and Tin. Semimetals are, Mercury, Antimony, Cobalt, Zinc, Bismuth, Arsenic, Platina and Nickel.

of these Zinc comes nearest to a perfect metal as being somewhat ductile.

Earths are, Absorbent, Crystaline, and Argillaceous.

The Absorbent Earths effervesce with Acids upon ye account they are sometimes called Alcaline, & those that may be reduced to quicklime are called calcareous.

Crystaline Earths are very hard so as to strike fire with Steel, & are sometimes called Vitrescent, white glass being made thereof.

Argillaceous Earths are ductile when moistned with water, & hard when burned:

to

* The Gypseum is commonly called Selenites & is not properly an Earth but a kind of neutral salt indissoluble in water composed of the Vitriolic Acid and a calcarious Earth.
" See Neumans Chemistry p: 30.

* This is a small Grotta at the foot of a Hill about 6 feet high, 12 long & 6 broad from the ground rises a thin subtle warm fluid visible to the Eye which does not appear as in little particles here & there but in one continued Steam covering the whole surface of the bottom of the Cave & has this remarkable difference from common vapors that it does not disperse itself into the Air but quickly after its rise falls back again. Meads Essay on Poisons

x Combination is the peacing of bodies in such circumstances as to unite with each other by means of the attractive law of nature.

to these some add Gipsum* and Talc. the Talc is called incombustible Earth & was manufactured by the ancients."

Water is either common or mineral.

Air is either common as that of the Atmosphere, or mephitic as in a Grotto near Naples;* this is destructive to life, that is, being unelastic, & therefore unfitt for breathing, any animal body immersed therein soon expires.

Chap 2d

Of the Operations of Chemistry.

The changes of the qualities of bodies in chemistry are all of them produced by, Combination or Separation.*

Combination depends upon Attraction, and this upon fluidity; which is employd in Solution, or Fusion.

Separation

* chemical Separation is the disjunction of compound bodies by adjoining thereto a body having a greater attraction to one of them than the other hath thereto; or by means of the action of fire

all fluid bodies may be rendered solid by cold, ever Mercury in Russia by means of artificial cold has been made to distend under the hammer.

Combination & Separation depends altogether upon Fluidity — In the resolution and recomposition of Nitre we have an Instance of all the operations of chemistry. Take Nitre which is compos^d of the nitrous Acid and an Alkali, add thereto Ol: Vitr: & it will dissolve it this is called Solution next vapors arise which are increased by fire, the rising of these is called Exhalation these being collected in the head of the still is called Condensation, the Acid obtaind is corosive & very different from the compound: The Ol: Vitrioli unitted to the alkali is an instance of Attraction which took place in fluidity

Separation depends upon elective Attraction, or the action of the Fire. *

[That bodies cannot unite or combine but in a fluid state is evident, for the particles of solids being unable to change place they therefore cannot be combined tho' bodies long comminuted together seem intimately joind yet their particles retain their usual figure & the bodies only compounded & mixt with each other.]

Elective Attraction is Absolute or Relative: single or Double.

Attraction is that law of nature, or power, by which certain bodies have a propensity of uniting with each other as suppose A has a propensity of uniting with B. it is called Attraction in general. Elective Attraction is when to two bodies compounded, a third be added, which has a repugnancy to join with

A uniting with B is attraction in general.
A not uniting with B but uniting with C
is elective attraction.
A & B added to C & D if then A should unite
with C or D and B with D or C. It is called
double elective attraction.
If A will not unite with B but will unite with
C its elective attraction absolute.
If A will unite with either B or C but from its
having a greater affinity with one than the other
chooses rather to unite therewith its called
elective attraction relative.

with one of them, but a propensity to join with the other. *

Double elective attraction is, when a body, which of itself, cannot decompose a compound, consisting of two substances because they have a greater affinity with each other than it has with either of them, becomes nevertheless capable of separating the two, by uniting with one of them, when itself is combined with any other body, having a degree of affinity with that one, sufficient to compensate its own want thereof. In that case there are two affinities & thence ensues a double decomposition and a double combination.

The following Tables shew the different attraction of bodies single and double.

Tables

Tab I. of Acids in general

1 Phlogiston
2 Fixed Alkali
3 Quicklime
4 Magnesia
5 Metallic substances
6 Volatile Alkali
7 Earth of Alum

II Vitriolic acid

1 N. 1, 2 3 & 4 as table first
2 Zinc
3 Iron
4 Copper
5 Silver
6 Tin
7 Lead
8 Mercury
9 Volatile Alkali

III Nitrous Acid

1 N°. 1, 2, 3 & 4 as table first

2 Zinc

3 Iron

4 Copper

5 Lead

6 Mercury

7 Silver

IV Muriatic Acid

1 N°. 1, 2, 3 & 4 as table first

2

3 Tin

4 Regulus of Antimony

5 Copper

6 Silver

7 Mercury

V Vegetable Acid

1 N°. 1, 2 3 & 4 as Table first

2 Zinc

3 Copper

4 Lead

VI Aqua Regia

1 N°. 1, 2, 3 4 of antea
2
3 Tin
4 Gold

VII Fixed Air

1 Metallic substances
2 Quick lime
3 Fixed Alkali
4 Magnesia
5 Volatile alkali

VIII Fixed Alkali

1 Vitriolic Acid
2 Nitrous Acid
3 Muriatic Acid
4 Vegetable Acid
5 Volatile Vitriolic Acid & vegetable Salt
6 Oil and Sulphur

IX Volatile Alkali

1 Vitriolic Acid
2 Nitrous Acid
3 Muriatic Acid
4 Vegetable Acid
5 Volatile Vitriolic Acid & Sedative Salt
6 Oils and Sulphur

X Absorbent Earth

1 Vitriolic Acid
2 Nitrous Acid
3 Muriatic Acid
4 Vegetable Acid

XI Alkalines

1 Acids
2 Fixed Air.

XII Water

1 Fixed Alkali
2 Alkohol
3 Neutral Salts.

XIII Water

1 Alkohol
2 Mild Alkali

XIV Alkohol

1 Water
2 Oil

XV Metallic Substances

1 Muriatic Acid
2 Vitriolic Acid
3 Nitrous Acid
4 Vegetable Acid

XVI Lead

1 Vitriolic Acid
2 Muriatic Acid
3 Nitrous Acid
4 Vegetable Acid

XVII Regulus of Antimony

1 Nitrous Acid
2 Muriatic Acid

XVIII Gold

1 Ether Essential Oils, Alcohol

2 Aqua Regia

XIX Silver

1 Mercury

2 Ammoniacal Salt

XX Silver

1 Lead

2 Copper

XXI Mercury

1 Gold

2 Silver

3 Lead

4 Copper

5 Zinc

6 Regulus of Antimony

XXII Mercury

1 Lead

2 Bismuth

XXIII Iron

1 Bismuth
2 Regulus of Antimony
3 Copper, Silver.

XXIV. Regulus of Antimony

1 Iron
2 Copper
3 Lead, Silver

XXV Arsenic

1 Iron
2 Copper
3 Tin
4 Lead
5 Silver
6 Gold

XXVI Sulphur

1 Fixed Alkali, Quicklime
2 Iron
3 Copper
4 Lead
5 Tin
6 Silver
7 Regulus of Antimony
8 Mercury

XXVII Sulphur

1 Mercury
2 Arsenic

XXVIII Sulphur

1 Mercury
2 Volatile Alkali

Of Double elective attraction

Case 1st

Corros. subl. { mur. Acid / Mercury ; Nitr. Acid / Silver }

Case 2d

Comm.n Salt { mur. acid / fixd alk. ; Nitr Acid / Silver }

Case 3d

Vitriolat Tart. { Vitr. Acid / fixd alk. ; Nitr Acid / Silver }

Case 4th

Vitr. Ammon. { Vitr. Acid / Vol. alk ; Veg. Acid / fixd alk. } { Tart. regen. / Veg. fix.

Vitr. Tart. { Vitr Acid / fixd alk ; Veg. Acid / Vol. alk } { Vitr Ammon. conv.t to

---

Case 3d

Explanatory Diagrams.

Mur: Acid ↖ ↗ Nitr: Acid
Mercury ↗ ↖ Silver

Mur: Acid ↖ ↗ Nitr Acid
Fixed Alk ↗ ↖ Silver

Vitr: Acid ↖ ↗ Nitr Acid
Fix'd alk ↗ ↖ Silver

The above 3 Cases are only an inversion of the preceeding Cases.

The Diagram to Case 4th cannot be perfect as it requires Fire to compleat the same.

Vitr: Acid ↘ ↗ Oil
Earth ↗ ↘ fixed Alk

In this Case a double decomposition will happen but but only a single combination.

In all cases, as Attraction in general, the Elective depends upon Fluidity, and therefore also upon Solution, or Fusion.

The five separates bodies in consequence of their different degrees of Fusibility, and acts by Fusion, or it does it in consequence of their different degrees of Volatility, & acts by Exhalation.

Hence all the several Operations of Chemistry may be referred to

1 Solution.
2 Fusion, or
3 Exhalation.

x Clay dissolved in water per minima is not solution but mechanical diffusion.

x[1] Mixture differs from solution in this that the latter retains its properties as salt dissolved in Water has the same properties as in a solid form; but mixture has its properties changed forming a tertium quid as a neutral salt composed of an acid and an alkali is different in all its properties from either of them separately.

Sect. 1st

Of Solution

Solution is the rendering of a solid body fluid by means of a fluid. The solid body to be dissolved is named the Solvend, the fluid applied to it the Solvent, or Menstruum.

Chemical Solution is to be distinguished on the one hand from Dissolution, which has been named Mechanical Solution, & on the other hand from proper mixture. *

Both in solution and mixture there happens a Saturation.

The vessels commonly and most properly employed in Solution are named Matrasses or Bolt Heads. When a Matrass is closed by another smaller inverted & joined to it, this is called

x Dr. Cullen was once called to a Lady who had got a gold Ring on her finger so fast that she could not get it he applyed mercurial unguent thereto and it became so brittle as to break easily: thus if the same Unguent be rubbed in the groin (as is often done in venereal cases) of a person wearing a gold watch it will render it so brittle as to break with every small blow.

called a Circulatory Apparatus.

Solution is assisted by the division of the Solvend, the agitation of the Vessel, & the application of heat & Air.

In the practice of Solution it is commonly proper to avoid Effervescence, and Dissipation.

The intestine motion named Effervescence, is to be distinguished from those of Ebullition, and Fermentation.

Solution according to different practices is named Maceration, Infusion, Decoction, Digestion, Circulation, Diliquescence or Amalgamation. x

Dissolved bodies may be separated from their Menstruums by Pre-

Precipitation, Crystalization, & Evaporation.

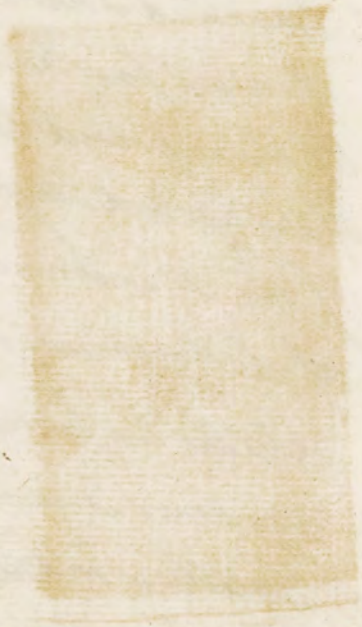
Precipitation belongs to this head. It depends upon Elective Attraction, & the body added is named the Precipitant.

There are four kinds of Precipitation
1 Of the dissolved body alone
2 Of the dissolved body with the Precipitant.
3 Of the Menstruum alone.
4 Of the Menstruum with the Precipitant.

In the two first Cases the any body falling down is named a Precipitate Magistery or Calx.

When a metallic substance can be combined with an Acid in any form only, the Combination is named Corrosion.

When a Precipitate has part of the acid which had formerly dissolved it still



Still adhering to it. the washing of that Acid by water is named Edulcoration.

In most of the practices of this section, there is occasion for Colature & Filtration, which are facilitated by a previous Depuration per subsidentiam

Most instances of Coagulation may be referred to Precipitation.

A very fine Powder may be obtained — by Elutriation. Some metals are made into a powder by Limation or filing: or Granulation as in the hardening of Iron, or Ignition & Extinction by which means they become very brittle. Glass may likewise be fitted this way: × That is by sudden heat & cold e.g. dip a thread in melted Sulphur and

wet

* If spirits of Nitre & Oil of Cloves or Cinnamon be mixed in a glass Vessel, the Vessel immediately bursts into many pieces, the room is filled w^th^ flame & noise & the persons presently all struck dead.

℞ Sp. Vini, evaporate it in a close room & in the night bring a Candle into the room the spirit will catch fire & the room appear all on fire w^th^ a sudden flash like lightning.

Oil of Vitriol being drawn off from its weight of Spirits of Nitre & from both a compound Spirit of Nitre be rectified; & two parts of this Spirit be poured on one part of Oil of Cloves — Carraway seeds or any pinguinous Oil, or Oil of Terebs: thickned with Bals: Sulphuris the liquor grows so hot in mixing as presently to flame.

set it on fire then apply it to glass & when fully heated apply sudden cold thereto & it will break in that peace

Many curious Phenomena appear in the mixing of different Substances. *

Expt. 1st Mix highly concentrated Vitriolic Acid, a piece of Iron be immersed it will fall to the bottom untouched, but if water be added to the Vitriolic Acid it immediately attacks the Iron & dissolves it.

2d. Put Iron filings into the Acid of Vitriol & effervescence will happen & fumes will arise, put a candle thereto, and they will immediately catch flame with Explosion.

3d. Mix Ether just hastily on the nitrous Acid it will effervesce so strongly as to fly off in fumes but if added slowly no such explosion happens.

Section 2.d

Of Fusion

Fusion combines by what has been named Dry Solution & separates by Elective Attraction or the Action of the Fire, in different degrees upon different bodies.

When an Elective Attraction takes place under Fusion, the operation is named a Precipitation by Fire, & in the Case of Metallic substances the parts separated are named Scoria and Regulus.

The Fusion of Bodies may be considered as of two kinds, the one where the body melted suffers no other change but that by the Action of the Fire, known as it becomes fluid & upon removing the

the fire the body concretes into the same form as before. The other case is where the body melted suffers such a change that upon cooling again it does not concrete in the same form as before. Of this the most noted instance is in the Vitrification of Bodies.

The fire operates under Fusion by acting upon the Common Fusibility or by acting upon the Vitrescency of particular Bodies.

Upon the first depend Liquation and Congelation.

Upon the second depend Scorification and Cupellation.

When a Metallic substance has been deprived of its metalline form & by fusion with inflamable matter as Char

Charcoal, brought back to it again
the operation is named Reduction:
except Quicksilver which is reduced by
distillation & is named Revivification.

The Vessels most commonly em-
ployed in Fusion are named Crucibles.

In Scorification &c: are employd
Test, Cupels, & Mouffles.

The different degrees of heat necessary
to Vitrify different metals is one
method of separating them from each
other, eg. Lead and Silver being melted
together in a Cupel which is commonly
formed the Lead Vitrifies & runs thro'
the pores of the Cupel leaving the
Silver only fused: this is called Cupellation:
but if the Container dont let the Vitrified
matter thro' but it blows off it is called Test.

Vert.

Section 3.d

Of Exhalation

Exhalation is various as it is practised for obtaining

The fixed Parts { Of Fluids by Evaporation
Of solids by Ustulation or Calcination

The Volatile Parts { in a fluid form by Distillation
in a solid form by Sublimation

Of a like nature with these two last but somewhat different in the manner of Operating are

Cementation & Inflamation.

under the last is comprehended what has been named the Sublimation of Geber.

Evaporation according to certain circumstances of the subject is named In-

Inspissation or Extraction.

Crystalization sometimes depends upon diminishing the Heat but more commonly upon diminishing the Quantity of the Menstruum.

e.g. Water in a cold state will dissolve 1/4 its quantity of common salt but when hot it will dissolve more after that if the same is suffered to grow cold that which it dissolved by being hot will Crystalize & no more. Then if those Crystals be taken & the quantity of water diminished by Evaporation, more crystals will form & so it may go on until all the whole is Crystalized.

Evaporation is properly carried on by the joint action of Fire & Air

Distill-

Distillation according to the subject is distinguished into Simple Distillation & Distillation with addition.

Simple Distillation is the ways but improperly named the Chemical analysis.

Distillation with addition.

This is made for several Purposes.

1 By an Elective Attraction for getting loose a Volatile Part.

2 By the same for fixing one of two Volatile Parts.

3 By the same for separating a fixed part & uniting with this for Volatil=
=izing of it.

4 By uniting with the whole of the mixt for Volatilizing it.

5 By dividing an Aggregate for prevent=
=ing

:ing its fusion & thereby for favouring
its revolution.
6 By avoiding any Aggregate for preventing
its Intermescence & thereby favouring
the separation of parts resolved.
7 For regulating the degree of Heat.

When a matter obtained by one distill-
:ation is subject to another second
distillation, that it may be entirely
separated from matters that adhered to
it in the first: such second distillation
is named Rectification, Dephlegm
:ation or Concentration.

When in the case 3.d & 4.th a matter
obtained by one distillation is returned
upon the same matter it had been
drawn from before, to be again distilled
from it for obtaining a stronger impreg-
:nation it is called Cohobation. Distil-

* An example of this we have in the common method of making Tar.

Distillation according to the form of the Vessels employed is distinguished into
1st That per Ascensum in which the Cucurbit & Alembic are employed.
2d That per Obliquum in which the Retort is employed.
3d That per Descensum in which the vapors are driven into a Vessel placed below the matter from wh. they are drawn. *

In the practice of Distillation regard is to be had
1st To the manner of putting the matter into the distilling Vessels & filling them to a propped degree.
2d To closing the junctures of the Vessels by Luting or otherwise.
3d To the proper application of the Fire.
4th To the preventing a great intumescency the matter subject to distillation.
5th To prevent the bursting of the Vessel

Vessels by the quantity, or the Elasticity of the Vapor raised in Distillation.

Sublimation is conducted upon the same principles as that of Distillation. Its products are different as they are in powders named Flowers or as they in solid Concretes when they are named Sublimation

Of the application of Fire.

In this we are to consider, The direction of it and the regulation of its degree.

The direction of the Fire is of 3 kinds

1 The Naked or Open Fire
2 The Reverberatory Fire
3 The Transmitted heat

The Regulation of the degree of heat depends upon

1.

1st The Nature of the Fewel
2 The quantity of the Fewel inflamed
3 The more or less centre inflamation of
the Fewel, 4th The quicker or slower inflam-
mation of the fewel depending upon the
Velocity of Air applied, determined by
Bellows, Water blast and
Adopile or the structure of the Furnace

The parts of a Furnace may be:
1 The Ash Hole
2 The Focus, 3 The Laboratory &
4 The Flue or Chimney
The chief species of Furnaces are.
1 The Forge 2 The melting Furnace
3 The distilling Furnace with a naked
Fire 4 The Assay Furnace
5 The Reverberatory distilling Furnace
6 The Iron foundery Furnace
7 The Pottery Furnace or Kiln
8 The distilling Sand Furnace
9 The Athanor
10 The Lamp Furnace.

Chap

* this is the most considerable & important part of chemistry.

x or of such as are natural / their natural History ~

Chap. 3d

Of Particular Bodies

Having considered, first the Principles & Objects of Chemistry, secondly the Operations whereby chemical changes are produced, we now pass on thirdly to consider particular bodies, proceeding in the same regular order as we first proposed by treating 1st. Of Saline Bodies 2dly Of Inflamable 3d. Of Metallic 4th. Of Earthy, 5th Of Watery & 6th. Of Aerial. explaining first their chemical History: secondly how separated or prepared by Art for particular uses, thirdly Consider their separate properties & their relation to other bodies, & lastly critically enumerate their various name or appellations.

x There are 2 genera of simple salts, Acids & Alkalis.
Of Acids there are 4 species, the vitriolic, nitrous, muriatic
and vegetable beside w^c there is the acid of Ants amber &c
w^c may be looked upon as varieties.
Of Alcalies there are 3 species, the fixed vegetable,
the fixed fossile, and the volatile Alkali.

+ The fixed Alkali may be distinguished from the
volatile as the former will give a red orange color
to a solution of quicksilver in the Nitrous Acid; whereas
the latter gives to this solution a white milky Color.

Sect 1st

Of Saline Bodies

Salts as before observed are either simple or compound. *

Simple Salts either Acids or Alkalis.

Acids are generally reckoned four; Vitriolick, Nitrous, Muriatick & Vegetable.

Alkalis are three, two fixed viz: a Vegetable & a Fossil & one Volatile. *

From these 4 Acids & 3 Alkalis are formed 12 compound or neutral Salts as follows.

- Vitr: Acid + Veg: alk: → Vitr: Vegetable → Tart: Vitriol.
- Vitr: Acid + Foss: alk: → Vitr: Mineral → Glaub: Salt.
- Vitr: Acid + Volat: alk: → Vitr: Ammoniac → Vitriol: Ammon:
- Nitr: Acid + Veget: Alk: → Nitr: Vegetable → Nitre
- Nitr: Acid + Foss: alk: → Nitr: Mineral → Cubic Nitre.
- Nitr: Acid + Volat: alk: → Nitr: Ammoniac → Nitr: Ammon:
- Muri: Acid + Veget: Alk: → Muriatick Vegetable → Digest: Salt.
- Muri: Acid + Foss: Alk: → Muriatick Mineral → Sea Salt.
- Muri: Acid + Volat: alk: → Muriatick Ammoniac → Com[n]: Ammon:

* There are 3 genera of compound salts, viz:
1st neutral, composed of an Acid & an Alkali,
2d metallic, composed of an Acid & a metal.
3d earthy, composed of an Acid & an Earth.

x in mentioning the bodies in wh the vitriolic Acid is found we shall observe the same order as in treating of bodies viz: 1st salts, 2d metals, 3d earths, 4th inflamable bodies 5 waters.
As to salts its only found combined wth the fossil fixed Alkali forming Glauber salts its found combined wth Iron, Copper & Zinc forming green, blue, & white vitriol,

The vitreolic Acid is in all electric matter the vnaps or shock being only a decomposition of it.

{Veget: Acid} of Coal {Veget: Alk: / Fos: Alk: / Volat: Alk:} and {Regen: Tartar. / Phlogisticated Rochelle. / Veget: Ammon:} commonly called Spirits of Hindererus. *

Beside these 2 compound or neutral salts there are Metallic salts, composed of an Acid & a Metal, as all the Vitriols: and Earthy salts, composed of an Acid & an Earth, as Magnesia Glaubers Salt, Alum, Selenites &c.

Of Acids.

1st Of Vitriolic Acid.

1st Its Chemical or natural History. Vitriolic Acid is a natural substance, never found pure, but combind with other bodies, as the neutral Sal Glauberi, Copper, Iron, & Zinc, forming the Blue, green, & white Vitriols; with Earths, as the Absorbent, forming the Magnesia Glaubers Salt; with the Absorbent part of Clay forming Alum & with the Calcarious Earth forming Selenites & Gypsum.

+ It appears upon careful trial that in sixteen ounces of sulphur there are upwards of fifteen ounces & six drams of pure vitriolic Acid void of phlegm: the inflamable matter by wch so large a quantity of that most corrosive acid in all its properties is so surprisingly changd amounting only to about a dram.

There are works carried on in England where from 16 Ounces of Sulphur they get 15, 5 Ounces of vitr: Acid. Neumann Morgans 2d Course

+ In the extraction of the vitriolic Acid from Vitriol or other fixed bodies by vehemence of heat: If the distilling vessel has any fissure or contracted any in the fire the acid receives a remarkable alteration. It now proves extremely volatile: emitting pungent & almost suffocating vapors in the Air & totally arising in distillation by a heat scarce too great for the hand to bear. It is so much less corrosive than the acid in its fixed state as to be safely tasted, when it discovers only a slight biting bitterness & roughness wch scarce any sensible acidity. It neutralizes fixed alkaline salts: but instead of expelling it is itself expelld from them by both the other mineral Acids. This volatile spirit kept for some time in a vessel not closely stopt looses its suffocating odor resumes its fruity acidity & all its former qualities.

Neumann's Chemistry

It is likewise found combined with sulphur, & with water & Air so far as there are extraneous bodies or particles therein that contains this Acid, & lastly there is scarce any body in which this Acid is not found in greater or less quantity.

2d. How separated by Art. The most common substance from wch. it is extracted is Sulphur green Vitriol & Pyrites. for the process see Macquer vol. 1. fol 225.

The Vitriolic Acid is rendered volatile by allowing the Air to pass in during the process. * concentrated Vitriol is best known by its specific gravity, when highest concentrated it is to water as 1850 to 10 or nearly. Fahrenheit ranges as 1877.5 to 10,000.

3d. Considered in its relation to other Bodies; * combines with alcaline salts producing heat. Is applied to an Alkali it produces heat & effervescence & has a stronger attraction than

* forming vitriols, with inflamable matter forming sulphur; with earths forming Alum, the bitter purging salt & selenites and with alcaline salts forming the fossile fixed alcali Sal Glauberi & the vegetable fixed alkali vitriolated Tartar & with the volatile alkali secret sal Ammoniac

x equal parts by weight of the vitriolic Acid and water produce the greatest heat.

therewith than any of the other Acids:
if mixed with oil it will effervesce &
turn black & upon distillation a pure sulphur
will come over — combined with Ardent
spirits it forms Ether. — it unites
with metals * If diluted its a menstruum
for Iron & Zinc; for Copper & other metals
& to be in a concentrated state
it requires a boiling heat to dissolve them:
combined with Earth it forms several salts
with water it produces heat, † but with
Ice cold. — it unites with Animal
& Vegetable substances producing heat &
blackness:

4: Its various Names.

Very highly concentrated it has been called
Al. of Vitriol, now commonly Sp: Vitrioli fort:
when diluted it's called Sp: Vitrioli or
Spirit of Vitriol tenu: when obtained from
Sulphur called Al. Sulph: Sp: Campan: it's
called also the universal Acid &c

* If the Acid of Nitre be mixed with an equal quantity of any of the aromatic Oils as that of Cloves, Sassafras Turpentine &c: it instantly bursts into a lucid flame with an excessive ebullition & explosion.

* Aqua Fortis is a menstruum for dissolving all metals except Gold. Its used by dyers in dying scarlet. by refiners in parting Silver from Gold: by bookbinders to marble the covers of Books: by engravers for etching on Copper or Brass.

2d. Of the Nitrous Acid.

The nitrous Acid is next in degree to the Vitriolic Acid, it is a fossile substance, & mostly found combined with an Alkali forming the Nitre of the shops; the methods of obtaining the Acid* therefrom are commonly three 1st. By means of boles & clays 2d. by means of green Vitriol calcined to redness & 3d. by means of a concentrated vitriolic Acid, this last method obtains it the most pure. it is of a greenish color when diluted with water & reddish when concentrated; when highly concentrated its specific gravity to that of water is as 15 to 8. Aqua Fortis is the same as the Nitrous Acid*

As to its relation to other bodies, it unites with Alkalis making an effervescence, but it attracts them with less

ease

The nitrous acid mixed with powdered Ice remarkably increases its coldness: The marine acid has this effect in a somewhat less degree, while the vitriolic produces heat with Ice.

Lewis's notes on Neumann's Chemistry p: 190

5 parts of the Vitriolic acid saturate 8 parts of a fixed alcali. ℥j of the concentrated nitrous acid saturates near ℥vij of fixed alcali.

less than that of the vitriolic Acid.
It unites with essential Oils & in a highly
concentrated state produces great heat &
inflames with explosion – it will not
unite with Sulphur, – with ardent
spirits it unites & forms: Ether, it is
the proper menstruum for silver & combines
with several other metals & Earths, and
with water it produces heat though less
than that of the vitriolic Acid, but with
Ice it produces greater cold. It unites
with Animal & Vegetable substances
the same as the vitriolic Acid.

As to its various names they are
Spirits of Nitre, Nitrous Acid, Glaubers
Spirits of Nitre, Aqua fortis &c.

NB ℥v. of the Vitriolic Acid ×
℥x of the Nitrous Acid
℥xxi of the Muriatic Acid
℥xv of the Vegetable Acid
} saturate ℥j of an Alkali.

x Mr. Bourdelin endeavored to prove that the Acid of the Salt of Amber is marine. vid Macquer Vol: 2 p: 210
mem: de l'acad de Sci de Paris An: 1742

3d Of the Muriatic Acid

This Acid is a natural substance, in the sea in great quantity, & is likewise dug out of the Earth, frothy in large pellucid crystals & thence called Sal Gem, it is likewise in Sal Ammoniac and as some say in Borax, Amber, & Animal and Vegetable substances, Urine &c.

It is commonly obtained from Sea Salt, from which it may be decomposed by means of Vitriol or Nitre.

Its properties are that of volatility; if obtained by means of the Vitriol; its specific gravity is less than that of the two preceding Acids; being to that of water as 12 to 10 & of a yellowish color; it exhales an incensible odor, will unite with other Acids & with Alkalis producing heat, & may be made to unite in small quantities with

Ardent

Ardent spirits but not to produce Ether,
& has a greater affinity with some Metals
than the foregoing Acids: it produces heat
with water & cold with Ice but in a less
degree than that of the foregoing Acids,
it is the corosive commonly used for anatom-
ical Uses. Aqua Regis is composed
of the Muriatic and Nitrous Acids, made
commonly by only adding the two Acids
together, this Aqua Regis is the only Menst-
truum for Gold, it likewise dissolves Tin &
is the Basis of a scarlet dye, it combines
with Earths forming a Terrium calcis and
added to the Oil of Turpentine it flames.

4th Vegetable Acid.

Vegetable Acid is only obtained from
vegetable substances, and they may be all
reduced to three viz: Native, distilled, and
fermented, Boerhaave reckons five, his
fermentous

* According to Homberg an ℥j of best Vinegar contains 18 g.rs of true acid. An Ounce of Sp: Sals 73 grains of true Acid. An ounce of Spirit of Nitre 2 ℥ 23 g.rs of true Acid. and an ounce of Oil of Vitriol 4 ℥ 65 grains. the rest being water.

* Vinegar is made from Cyder, by drawing off the clear Cyder, (the meanest sort will do) into another Vessell, adding a quantity of must or powze of Apples setting it in the Sun or a warm place a Week or 9 Days & then draw it off.

Fermentans is the same with what Helmont calls Gas oxyleothe, which is suffocating & nothing more than the fixed air of the body flying off.

Native vegetable Acid is obtained by expression from Limes, Sorrel &c: which should be inspissated (if wanted to belong kept) to the consistance of Honey to prevent its fermentation.

Distilled vegetable Acid is obtained from most substances particularly Pine.

The Fermented vegetable Acids are acetous or Tartarous, the acetous is * very easily & fully concentrated by means of congelation exposing it to extream cold or else by means of copper or combining it with an absorbent earth. *

Its specific gravity differs little from that of water it joins with Alkalis, Earths &c: it will not unite with Ardent Spirits nor Oils, corrodes metals & checks fermentation like all other Acids.

Of Alkalis

1st Vegetable Alkali

This Alkali is obtained only from vegetable substances by means of calcination the vegetable substances from which this Alkali is obtained are of three kinds, 1 Vegetables themselves in their natural State 2 Fermented vegetable substances as that of Tartar 3d Nitre. It is most advantageously gotten from hard woods while green for when dry they loose some of their principles by the inclemency of the weather. The wood should be burnt to Ashes not in an entire open fire, but in an iron Pot. the Ashes itself is used in making Soap Bleaching &c. Soap makers make a Ley of the Ashes which they boil till its strong enough to bear an Egg & then add the Oil or Fat, the water should be cold when added to the ashes that it may not dissolve the

* Gold may be made to dissolve in Water by means of Hepar Sulphuris, hence Stahl * conjectures Moses employd this substance in his process on the Golden Calf Exod: 22d.

See Margraves Vol 1: 30)

* vid his tract de vitulo aureo

the ~~Vitriol~~ vitriolated Tartar &c is mostly formed therein.

This Salt may be got elegantly white from Tartar by means of burning & Lixiviation & then vetting a container by that which has the lixivium in it & putting one end of a rag in one & the other end in the other it will answer the end of a syphon during Evaporation carrying the purer parts out of the former into the latter vessel.

Joined with Acids they will unite with effervescence unless the Alkali be deprived of its fixed Air, when so they unite without effervescence. they unite with Oils forming Soap & with Sulphur making Hepar Sulphuris* Spots are brought out of cloaths by forming an union of the Alkali there with it. they unite with Metals & by means thereof the Earths may be Vitrified, it dissolves concretions & checks Fermentation.

Its appellations are Ol: Tart: Pot Ash fixed Nitre &c:

2. Of the Fossil Alkali

Fossil Alkali is a native fossil substance found pure in some of the eastern parts of the World called by Pliny Natrum it is oftner found mixed with the muriatic Acid forming sea salt or with the Acid of Borax forming Borax & in all vegt Plants a Kali. The properties of the Fossil Alkali are nearly the same with that of the Vegetable Alkali but known therefrom in this that the Vegetable Alkali strongly attracts the moisture of the Air, but the Fossil Alkali rather parts with its moisture in any Air

Joins with Acids, Oils, inflamables &c. like the Vegetable Alkali.

* A remarkable property in Hepar sulphuris is observed in sympathetic Ink, for a strong solution of Cochenum & Saturni being wrote with on clean paper, then a solution of the Hepar sulphuris being applied to another paper so as to moisten it, the first being laid at one end of a book or quire of paper & the other at the other & pressed hard together sometime, the letters wrote on the first paper with each Saturn will become Black and plain to be read

3. Of the Volatile Alkali

This by some is reckoned a natural subst=
=ance: it is found in all Soots Animals &c:
It is commonly obtain'd from Animal
substances by distillation per se.

It readily assumes the Air: when in
a Caustic state, it emits a very pungent
Odor, & joins with Acids as other Alkalies.
It joins with Oils making Soap, & with
Sulphur making Hepar Sulphuris *
when not caustic & added to pure Alkohol
they will immediately become solid.
It unites with Essential Oils when in a
Caustic state making the Sal Volatile
Oleosum: it volatilizes all substances
with which it will unite, prevents
Fermentation & is procured in greatest quan=
=tities from the most Solid parts of Animals
as Shafts of Hartshorn & is rendered Caustic
by means of Quicklime as the Sp: Sal Amm: Cau: &=

Of Neutral Salts

These salts are called by several names as Sal Salsum, sal Enixum & Salomedium, the latter from a supposition that they partook of the properties of an Alkali and an Acid both, which however they do not, but make a tertium quid or body different from either as is evident in the Spiritus Mindereri. The best way of making this neutral mixture is to add the Acid to the Alkali in small quantities & keep stirring with a Spatula till it is saturated which is better known by its remaining neutral when added to Syr. of Violets than by not Effervescing.

There are several methods of decompounding neutral Salts as by Fire alone, fire and Water & by Elective Attraction

Table of Vitriolated Tartar.

			Different Names
1 Vitriolic Acid	— Veget: alkali	. . .	Vitriolated Tartar
2 Vitriolic Acid	Nitre	. . .	Nitrum Vitriolat: E: Disp:
	Digestive salt	. .	
	Regenerat: Tartar		
	Soap of Veget: alk:		
	Hepar Sulphur d°		
3 Vitriolic Ammoniac	Veget: alk:	. .	
Vitriols	d°		
Alum	d°		
Selenites	d°		
Magnes: Glaub: salt	d°		
Sulphur & Ores	d°		
4 Vitriolic Ammoniac,	Nitre		
d°	Digest: salt		Sal Mixtum Paracelsi
d°	Regenerat: Tartar		Sel de duobus
Vitriols	d°		Arcan: Duplicat:
Alum	d°		
Selenites	d°		
Magn: Glaub: salt	d°		
Sulphur	Nitre		Sal Polychrest:
Antimony	Nitre		Nitrum Fibiatum E: Disp:

Table of Glauber's Salt

1 Vitriolic Acid	Fossil Alkali	
2 Vitriolic Acid	Cubic Nitre	
	Common salt	
	Polychrest of Rochell	
	Soap of Fossil alkali	
	Hepar Sulphuris d°	
3 Vitriolic Ammoniac		
4 Vitriols		
Alum		
Selenites		
Magnes: Glaub: Salts		
Sulphur and the Ores		

1st Vitriolated Tartar is an artificial substance, composed of the Vitriolic Acid and Vegetable Alkali, the manner of doing which is various, as 1st adding Salt of Tartar to the Vitriolic Acid. 2d by adding the Vitriolic Acid to some compound having the Vegetable Alkali therein. 3d by adding the Veget. Alkali to a compound having the Vitriolic Acid therein and 4th by adding a comp.d having alk: in to a comp.d having Acid and by from the various methods of obtaining the same it has received various names as Nitrum Stibiatum, Sal Polychrestum, Sal Enixum, Sal Enixum Paracelsi &c.

The crystals of Vitriolated Tartar are hexagonal, it retains dry in the Air, & is scarce soluble in water & not at all in Alkahol, it decrepitates on the fire & is not fusible but by means of a burning Glass.

2d Glauber Salt is sometimes found native in Springs, it's composed of the Vitriolic Acid & fossil Alkali, its crystals are hex

* Gun Powder according to D. Shaw is made as follows. ℞ Refined Nitre ℥iv
Sulphur ℥i
Charcoal ℥vi pulv ad subtilissi: continue beating them for some time in a stone Mortar with a wooden pestle wetting the mixture between while with water so as to form the whole into an uniform paste w.ch is reduced to grains by passing it thro' a wire sive for that purpose and carefully dried.

Nitre is never found in a perfect state in the Earth. Putrefaction is necessary for the production of the nitrous Acid which is often generated in certain stones which discover it by their efflorescence & are called nitrous Stones though they contain no pure Nitre wanting the alkali w.ch is produced by Art only — Nitre may be made of these Stones by elixiviating them then adding a vegetable alkali & evaporating and crystalizing the same.

Hexagonal & near 3/4 water which makes them dissolve the easiest & in the least quantity in water of any salt, & they are the most fusible by heat & least subject to run per deliquium in the air of any salts.

3. Nitre* is composed of the Nitrous Acid & Vegetable Alkali, its crystals are hexagonal not disposed to run per deliq: in the Air & takes six times its weight in Water to dissolve it. It flames & the basis of all substances when added to a Phlogiston & upon that account much used in martial Arts, & has a fulminating quality, checks Fermentation & remarkably resists putrefaction.

4. Cubic Nitre is composed of the Nitrous Acid & fossil Alkali its crystals are rhomboidal its solubility fusibility &c: nearly the same as that of common Nitre.

5. Sal Muria is a native salt found in great quantities in the bowels of the Earth

× And in a variety of Salt Springs.

* It seems more probable to suppose the Sea was originally salt as Fishes were made at the Creation many of w.ch as the Whale could not live without Salt water.

Sal Gemm. has been found in such large solid masses that Chappels, Altars, Pillers &c. have been hewn out of them.

× Called in the London Dispensatory Spiritus Salis Marini Coagulatus.

Earth particularly Lithuania & called Rock salt, Sal Gemm &c. it is likewise found in all places where Nitre is & abounds in the Sea, from whence it is mostly obtained. x

This salt is compounded of the muriatic acid & Vegetable Alkali, & is supposed by some to be in the Sea only in consequence of the water running from the bowels of the Earth & carrying this salt along with it into the Sea; from thence the Sea may be said to be continually growing salter. x It is obtained therefrom by Evaporation, by means of the Air, culinary Fire or the Sun, the latter the best way.

Whiteness, pregnancy & exact cubic Crystals with solidity & no great deliquescency in the Air, are the marks of its pureness.

Its great Antiseptic quality make it much used in preserving flesh &c.

6. Digestive Salt is an artificial production composed of the Muriatic Acid & Vegetable Alkali its properties much the same as the preceding Purg-

7th Regenerated Tartar is composed of a Vegetable Acid & Vegetable Alkali.

Tartar Soluble made of Crystals of Tartar & Salt of Tartar is much the same as the regenerated Tartar being only a diffr preparation.

The crystals of the regenerated Tartar are mostly laminous & from thence it has got the name of Terra Foliata Tartari it is deliquescent and dissolves in Alcohol.

8th Sal Polycrestum is composed of a vegetable Acid & fossil Alkali called from its inventer Sal Veginette & from the place where it was first made Salt of Rochelle. it is less soluble in water & less deliquescent than the regenerated Tartar and it will not dissolve in alcohol.

9th The Volatile Alkali added to the different acids form different kinds of Ammoniacal salts; the common Ammoniac has the muriatic Acid joined with the volatile Alkali for its basis.

* Common Ammoniac is made by subliming common Salt, Soot & Urine together.

There is a Sal Ammoniac Works at Edinburgh but the particular Encheiresis is kept a secret!

It is fabled that the name Ammoniac is derived from the temple of Jupiter Ammon being first found there, generated from the Urine of their calcified Camels, it is sometimes found in Volcano's but it chiefly brought to us from the Levant, it made chiefly of soot: *

Its appearance is that of Specular or Stars, six or four sided, very soluble in water, requiring only about three times its weight of water (perhaps from its having Sea Salt in it.) It helps the solution of all other Salts, it is soluble in Alkahol not readily decomposed by fire alone by reason of its volatility. Sal Ammoniac dissolved in water renders it colder than any other Salt, M. Homberg ordered a lb of Sal Ammon: & Corrosive Sublim: to be made fine seperately then to be mixed together

in

* From this property it rec^d the name of Nitrum flammans: it is perfectly dissoluble in highly rectified Spirit of Wine.

in a Mattrass & a pint & a half of distilled Vinegar put thereon & the whole shook briskly together & it became so cold that he could not hold his hand therein.

10th Vitriolic Ammoniac is composed of the Vitriolic Acid & Volatile Alkali never got in the fossil kingdom more soluble in water but less in Alkohol than the common Ammoniac. It was first found out by Glauber & thence called Glauber's secret Sal Ammoniac.

11th Nitrous Ammoniac is composed of Nitrous Acid & Volatile Alkali distinguishable from the preceding by its inflamable fulminating quality. *

12th Vegetable Ammoniac is composed of the Vegetable Acid & Volatile Alkali is commonly called Spiritus Mindereri, it may be obtained dry by distillation. D. Ward it is said used to dissolve this Salt in some fluid for resolving Cancerous Tumors.

Borax

x Borax is a saline substance composed of two principles viz: the fossil fixed Alkali & a peculiar substance (about 1/4 of the whole) called Sedative Salt. The properties of this substance are these, It is of a bright & snowy whiteness, extremely light, composed of fine plates or scales, soft as it were unctuous to the touch, of no smell, of a bitterish taste accompanied with a slight impression of coldness. dissolves difficultly in boiling water, by heat it melts emits aqueous vapors & runs into a vitreous substance dissolvable again as at first, not affected by the Air. It makes no change in the color of blue flowers. It unites with common Alkalies in some degree neutralizes & renders them capable of crystalization. It is said to expel from Alkalies every Acid except the vitriolic though expelled itself by every Acid from the alkaline basis of the Borax.

* Borax is used by dyers to give a gloss to Neumann Silks & in Italy the Ladies use it as a Cosmetic.

The Acid of Ants bears a greater analogy to the vegetable than mineral, for its particular properties vid Lewis's notes to Neumanns Chemistry page 199.

Mr. Pott in the Berlin memoirs has given a curious set of experiments on the Salt of Amber from wch. its Acid appears plainly to be essentially different from the three mineral Acids & approach nearer to those of the vegetable Kingdom. for an abstract of wch. see Lewis's Notes to Neumann

Of Borax

x Salt of Borax or of Homberg is of a particular kind found to be composed of a fixed Alkali & an Acid peculiar to itself called the Acid of Borax, it changes the Syr: of Violets green helps the fusion of metals & is a neutral salt dissolves in Alkohol & with great heat forms a kind of Glass on which is voluble in hot water, upon distillation it yields an Acid called sedative salt, this Acid neutralizes Alkalis & forms ~~Borax~~ therewith Borax. *

There is likewise said to be found in Anta # a particular Acid differing from all the preceding.

+ The Acid of Amber is likewise reckoned to be of a particular kind which joined with a fossil Oil forms Amber.

Arsenic is by some reckoned a particular kind of Acid it expells the nitrous Acid from its alkaline basis & therewith forms a new saline compound.

* Inflamable substances are such as flame &c. in contact with any burning substance.

They are generally reckoned of three kinds, (on the opposite side) and the burning quality of all bodies is supposed to be owing to one or more of these substances being in them and chemists say that each of these substances is likewise a composition of a Phlogiston with some other substance; & that they owe their inflamability to the Phlogiston; thus they say Phlogiston united with a certain substance forms oil, with Acid forms Sulphur, and with a third substance forms Ardent Spirits; hence bodies owe their inflamability to Oil, Sulphur or Ardent Spirit and each of these again owe theirs to a Phlogiston — the two former are not miscable with water but the latter is.

* Expressed Oils are distinguished from essential ones by not having the peculiar flavor of the substance they are obtained from — when pure they are bland to the taste as well when obtained from the most acrid substances as Mustard seed as when obtained from the most mild as almonds: they are obtained by Trituration, Maceration, Heat & pressure.

Animal Fats are found in the heat of the living body.

Query, Whether does expressed Oils grow rancid of themselves, or else owe their rancidity to the mucous matter adhering to them? The latter seems the most probable as the the more they are purified therefrom the longer they continue mild.

Section 2d

Of Inflamable Bodies

Inflamable Bodies as before observed are generally divided into three kinds viz. Oils, Sulphur, and Ardent Spirits. x

Of Oils

Oil is an unctuous dry, inflamable & not Soluble in water.

Oils are Animal, Vegetable & Fossil. Animal & Vegetable Oils are Expressed, Essential, or Empyreumatic. the Expressed and Essential are natural, but the Empyreumatic is the product of fire. The Expressed Oils whether Animal or Vegetable are apt to concrete and subject to rancescency, the Animal Oils or Fats are white when pure, unite with Acids & with Alkalis forming Soap. 16 parts of Oil to one of Sulphur makes the balsam of Sulphur, added to the Calx of Lead they form Diacylum, they wont unite with Water or Earth. x

Essential Oils was formerly supposed to be only Vegetable but the Oil of Castor, Amber &c. Musk proves

Oil is composed of Phlogiston united with Water by means of an Acid, having likewise a portion of Earth in it. That they contain Phlogiston is evident from their inflamability an Acid is likewise discovered by triturating them w^th^ Alkalies, by their corroding Metals &c. Water & Earth may likewise be obtained from them by a chemical enchiresis.

* Essential Oils are generated in consequence of the vegetable or animal Oeconomy as is evident from their containing the flavor of the substance from which they are obtained; this is the Criterion to distinguish them from expressed Oils.

* Balsam of Sulphur is generally made of Essential Oils — essential Oils are not so readily combined w^th^ Alkalies as the Expressed.

proves the contrary, they having all the properties of Essential Oils. these Oils are obtained from plants by distillation in Copper Vessels, mostly when they have obtained their fulll growth; Common Salt preserves these Oils.

Essential Oils are very fluid but grow thick by Age, Boerhaave reckons a Spiritus Rector in all bodies which tho' he supports by a philosophical Hypothesis amongst others the thickning of these Oils, is not however evident & perhaps the different effects & properties of bodies arise from the different modes of matter, altered by some means or other.

With concentrated Acids they unite with effervescence & even flame, combined with Alkali, they form a soap, unite with Alcohol generating cold, wont unite with any Earths except Quicklime.

* The Tree w.ch produces the Camphor is a species of Baytree obtained thereformas follows

The Natives cut the wood & Roots into small pieces put them into large Copper Vessels w.ch they cover with earthan heads filled with straw & raise a moderate heat under it, & the camphor raises in form of a white downy matter adhering to the straws when the process is over they shake of the camphor knead it into Cakes. and is called rough Camphor.

Camphor may probably be obtained from all plants w.ch abound with an essential Oil.

Vid Philos: Trans: how M.r Neuman extracted the camphor from Thyme.

Camphor sui generis is somewhat like essential Oils only solid obtained from Vegetables & burning gives little soot. *

Other bodies referred to this head are Balsams & Resins which are perhaps only thickned Oils; they are soluble in alkohol.

Empyreumatic Oils are so called from their having received an Empyreuma by the Fire, their properties are all nearly the same, with the utmost heat they become thick & black & are called Charr — Ol of C C. as commonly called is of this kind & distilled till it grows transparent & limpid has been supposed good in Epilepsy as also the Ol Later.

N3. Expressed Oils are not soluble in Alkohol but upon repeated distillation they become so, whereas on the contrary essential Oils are soluble tho' never but repeatedly distilled not so.

Sulphur is a fossil concrete, not soluble in Water nor Spirits of Wine it is sometimes found pure in the Earth when so it is transparent

Sulphur will unite imperfectly with Acids, with alkalies it forms Hepar Sulphuris which is soluble in alcohol and water and metals and other coulstanus are tarnished by its steams hence the property of sympathetic Ink. The volatile alkali must be rendered Caustic to combine with Sulphur

* Except Gold and Tine wch are soluble in Hepar Sulphuris

It is supposed that there is but one Fossil Oil & that all the difference arises from impurities as Nephtha, Petroleum Bitumen &c. the inflamable part of Charcoal &c. there are two fossils alike peculiar viz. Amber and Ambergreace, there are two Chemical preparations of Amber used in Medicine the Oil & the Salt, the Oil coming over first & after that the Salt.

2d of Sulphur

Sulphur, is an inflamable substance burning without any soot, found alone in the Earth or in the Ore of metals, or with Arsenic. making the Auripigmentum the Tarnic & got from the Pyrites &c. by Sublimation. Sulphur may be formed by adding the Vitriolic Acid to Oils Alkohol or Opium. Sulphur cannot be decompounded but by Fire, is soluble in Oils and it is a Universal Menstruum for metals. Gold is said to be soluble in water by the Sal Sulphuris

so as to produce a change in the whole substance.

That a fermentation sometimes takes place both in animals and vegetables sometimes might easily be proved as in the small Pox some diseases in vegetables &c.

3. Of Alcohol

This a dispute amongst the chemists whether Alkohol be only the effect of the vinous fermentation or not; for if Lead be dissolved in Vinegar & the same distilled an Alcohol will be produced, but it is generally procured by means of the vinous fermentation & therefore I think it most proper to speak of Fermentation in general in this place.

Fermentation is a certain intestine motion excited in a fluid; x Vegetable substances are the most subject to ferment, & is proper to divide the vinous fermentation into 2 Classes 1. Such bodies as ferment spontaneously as the Sugar Cane, Wine &c. 2. Such as are made to do so by Art, only as malt &c. The requisites for Fermentation are 1. fluidity, to dissolve at least 1/3 its wt. of water. 2. a certain exposure to the Air. 3. Kindly moderate heat between 46 & 60 degrees on Farenheits Thermometer 4. Rest. Soon after the fermentation is begun bubbles

Bubbles arise & froth or flowers appear on the top of the Liquor which if taken off check the Fermentation, & the fermentation is known to cease when pushing the flowers to one side of the Vessel they do not return again. during the Fermentation a substance of Gales called by Boerhaave Gas Sylvestre which is noxious & from its exhaling quicklime is known to be nephritic Acid and at the bottom will be a sediment called Lees. in Wine Tartar.

Fermentation is checked by heat, Lightning, the Fumes of Sulphur, stopping the Vessel close, by Acids, Alkalis, Absorbent Earths, and neutral Salts, Oils Mucilag. of Gemins, Alkohol &c.

D. Pringle is of opinion that the vinous acetous & putrid Fermentations are all but different stages of the same Fermentation.

Wine is not perfect by the first fermentation but has a second insensible one otherwise called having Age. Wines are subject to two diseases the first a Rapidity, the second becoming Acetous to hastily. Alkohol is the best Condament for Wine.

Ice

Of Wines

The varieties observed in Wines are 1st Crude or Mellow, 2d Strong or Weak, 3d Sharp or Sweet 4th Austere & Acerb or Smooth.

Cause of this difference in Wines,

Of Ales

The farinaceous Seeds as the Cerealia & legumina together wth some farinaceous Roots as Potatoes, by a particular treatment are disposed to vinous fermentation. The previous treatment of the subject is called malting, we shall only mention one that is most common Barley which belongs to the Cerealia.

1st The Barley is steeped in water till it softens & swells then its laid in heaps till it begins to germinate, the germination is known to be far enough advanced when the radicle & pleume appear, when this happens its spread out thin & dried by the heat of the Sun or culinary fire.

The Malt is to be broke down and mashed by steeping it in warm water until a proper Tincture is extracted wch after straining is fermented with yeast.

Malt liquors are more subject to become vapid and acetous than wines for which reason Hops are generally used as a condiment.

The Alkohol is produced by distilling the vinous spirit after fermentation, altogether from the Wine Lees &c. in an Alembic &c.

It is known to be pure two ways. 1st by its specific gravity 2d by a quantity of alkali remaining untouched therein & when so it is all the same, tho' obtained from different Liquors.

The Properties of Alkohol are, it is very inflamable, burning without leaving any residuum, or making any soot. And Boerhaave thinks it is an Element or simple body; it contains a vegetable Acid in it as it will make a kind of generated Tartar by being distilled with the Vegetable Alkali: it contains the Phlogiston which chemists say is an Acid combined with some other substances. An Alkohol may be distilled from Leech. Satiumi & it seems probable to suppose, that it was contained in the Vinegar before united with the Lead but

moved

not give it out until combined with that
metal forming a salt,

Alcohol will unite with the Vitriolic
& Nitrous Acids forming Ether, which has
been so much celebrated of late in Physic
In the making of Ether, it is best done
by means of a pint Alcohol & as well concentrated
Acids of each equal weight, first
put the Alcohol in a retort & then add thereto
the Vitriolic Acid by little at a time, stopping
the vessel during effervescence, then luck on
the receiver, & apply a gentle fire, first while
arise some of the Alcohol next the Ether & if
continued, lastly the Vitriolic Acid. Ether is
purified from any alcohol or acid being mixed
with it, by being put in water which the pure
Ether will rise at the top like Oil & may be
poured off by a gentle inclination of the Vessel.
or by means of a glass Tunnel.
Ether is extremely Volatile, a drop of it
upon the hand will make it feel cold remarkably
and

* Hence the frequent colds the Ladies get by setting in a damp room soon after it has been washed & before it is thoroughly dry.

× These there letters are Alchymic characters signifying Color, odor, and Sapor.

" This is a very curious phenomenon, thus if Gold be dissolved in Aqua Regis and vitriolic Æther be added the Aqua Regis will be precipitated and the Gold will be suspended by the Æther. with the nitrous Æther the Gold is not suspended but precipitates to the bottom.

Æther has long been known by the name of Spiritus vitrioli dulcis or Spiritus nitri dulcis Hoffmans mineral Liquor so often mentioned in his works is nearly the same.

It is a question whether any of the dulcified Spirits differ much from each other, therefore we need not be very solicitous of obtaining a dulcified muriatic Acid as it hard to make.

An Æther has never yet been produced by means of the muriatic or vegetable Acids.

* As to neutral salts it admits of union only w.th Regen.d Tartar
It is a powerful antiseptic & checks fermentation —

and evaporates suddenly and D. Cullen has discovered that cold is excited in all bodies by evaporation; * Ether blown up in bubbles & a candle put near them they will explode. Ether unites with oils & is said to extract the CO_2 from vegetables. it will extract Gold from Aq. Regis & hold the same when dissolved therein suspended tho' the Gold is the heaviest & the Ether the lightest of all chemical bodies". Nitrous Acid will form with Alcohol the Ether by digestion only, & in this mixing equal parts by measure the Alcohol may be somewhat diluted with water, & the Ether will form at top & may be separated therefrom by decantation, it will unite with Alkali only in a caustic state & its uses in medicine is not known.

Alkohol unites with oils that are Essential but not expressed, it will not freeze in the 30° of Fahrenheits Thermometer. metals by means of Alkalies are soluble in Alkohol & unites with water a small degree of generating heat, & coagulates the Animal fluids. * Salt

* Arsenic and Sulphur seem a necessary principle in the mineralization of metals.

When any metal is found in a metalline state in the bowels of the Earth it is called virgin metal.

Gold is often found in a virgin state, Silver sometimes the horny Ear of Silver is mineralized by Arsenic & the vitreous by Sulphur

The Galina Ear of Lead breaks at right angles

Section 3d

Of Metals

Metalline substances seem to be the first on which chemists were employed, we have before given the definition of metals & divided them into metals & semi-metals the former malleable the latter not malleable, we likewise divided the Metals into noble & ignoble, these metals are never scarcely found pure except Gold but in a mineral state in which they are called Ores

Ores are metalline substances combined with sulphur or Arsenic or both. x

Gold is sometimes found pure, but it is mostly found adhering to a stone called quartz.

Silver is often found in the same matrix as Gold, or beautifully mixed with the Ore

Ores are of two sorts first the horny Ores of Silver & the Vitreous Ore. *

The Ores of Lead may be reckoned two, the first united with sulphur & called Galina and the other Spar tinged yellow & green.

The Ore of Tin is mostly of a crystaline concretion & deep brown or blackish colour.

Copper

x A solution of Copper in Aqua fortis stains Marbles & some other stones of a green color; precipitated wth Chalk & whiting it yields the green and blue verditer of the painters.

Neumann's Chemistry

x Iron in its calces affords red and yellow pigments to the painter & Prussian Blue wch is prepared by precipitating a solution of green vitriol and alum with a Lixivium drawn from first alkaline salt that has been calcined with animal coals.

Some Pyrites are diliquescent in the air from them a yellow substance is often washed out called Asher.

" Oxide Antimony is Antimony mineralized & contains a quantity of sulphur.

x Platina jospes most of the properties of Gold & adpt it color wch is near that of Silver & hence it has been called white Gold its specific gravity to Gold is as 10 to 19 its soluble in Aqua Regia but not ductile.

v. Naumann.

Copper Ore is mostly the yellow coloured Pyrites. * Iron is likewise in the Pyrites, this metal is so common as to be in almost all bodies; Haller says Iron is found in the human body. *

The Ore of Quicksilver is only by being combined with Sulphur & is called Cinabar.

Zinc is found in the Lapis Calamenaris.

Antimony is commonly found in that form in which we call it crude Antimony. "

Bismuth commonly is found in that substance called Cobalt, from which there is also got another substance called Cobalt.

Platina is a substance lately discovered it is found in the mines of Peru & in its pure state it is nearly as heavy as Gold *

Nikil is lately discovered & scarcely known.

Nichel is a white semimetal its specific gravity to water is as 8 1/2 to 1, it melts in a white heat & unites with silver, Quicksilver, or Zinc, but not with all the other metals.

v. Neumann.

x Lead and Tin are easily Calcined & therefor we should be careful not to use too great heat in fusing them.

Iron & Copper are sooner calcined by a small than great heat therefore we should raise the fire suddenly.

Zinc Bismuth & Cobalt are subject to be volatilized by great heat

The different degrees of heat necessary to vitrify different metales serves as a method of separating one from the other.

Of Assaying Metals.

Metals require different degrees of heat to render them fusible. Copper & Iron want more than a red heat to fuse them, Lead and Tin less than a red heat, Gold & Silver fused.

During fusion we should take care to prevent Calcination, or Vitrification, as all Metals may be calcined by fire except Gold and Silver. Lead is the most subject to vitrify, next Bismuth, then Iron, & Antimony, the rest not vitrifiable unless some vitrifiable matter be added thereto.

The first step is to separate metals from their Matrices, this may sometimes be done by the hand or an Instrument by breaking the metal from the matter it adheres to, and is called Dressing of Ores: at other times by pounding it, washing it with Water, & then roasting it to free it of its Sulphur, & preventing its Volatilising during fusion, for

There are two ways by which Gold is separated from its Ore or matrix, by amalgamation or fusion.

For Sulphur volatilizes metals; thus Silver is not volatile of itself but by Sulphur it may be rendered so, & also with Arsenic: some metals may be separated by mere Electric Attraction. Some metals are very hard to flux, unless some matter is added which promotes the same, these are many as all Salts, whether fixed, Alkaline or Neutral. Borax, is a powerful fluxer, also common Salt, Selenites, Gypsums, the Helvitreum, Vitrescent Earths, Quart, and Glass, as Glass of Metals, particularly the Glass of Lead, and Hepar Sulphuris.

To prevent Calcination, Charcoal is universally used.

Gold is separated from its Ore by Amalgamation with Mercury. &

Silver is separated by Lead or amalgamation Cupellation with Quicksilver by Sublimation or Distillation

adding

Adding Iron or other substance to
Absorb the Sulphur.

Zinc is apt to rise in flowers, but if
Charcoal be added it will arise in a metallic
Form, . Bismuth is separated by
Elutriation.

Gold according to Boerhaave is separated
from its Ore as follows 1st torrify the Ore
2d gently bruise the mass & boil it in Water
till it has lost both taste & colour 3d They grind
the mass into Powder & boil it with Mercury
& Salt 5 or 6 Days, what remains dried &
strongly pounded with Mercury in a Mortar
till Amalgamated, then washed clean.
4 What remains they put in a Crucible or
Iron Vessel set it on a naked fire & after an
intense heat all the metallic matter falls
to the bottom, & the Scoria rises to the Top
5th they take off 5th they separate the
Mercury by distillation & if there is any
Silver with the Gold they separate it by
means of Aqua fortis.

Silver is separated also from its Ore by first bruising & roasting the same then washing it well & cupelling it with Lead or amalgamating it with Mercury & then separating it from the Mercury by distillation

Iron according to Boerhaave is separated from its Ore by first calcining the pounded Ore by vitrifying it with Coals: then fusing the same by a violent fire and the metal received into moulds in a fluid state like water.

Copper is hard to be separated, it must pass thro' 4 furnaces according to Erckens before it is pure.

Tin says Boerhaave is found in a heavy spongeous stone resembling a bone half burned, it is separated therefrom by powdering & washing the same and then fusing it in a hot fire, by which means the scoria is emitted & the tin left pure.

&c

× In the days of Archimedes mixed metals where thot to be of the same specific gravity with the metals in a separate state but this upon trial is found to hold true in very few.

× Thus some metals have a finer grain on being mixed.

‖ Tin united with Copper is capable of receiving a very smooth Polish & forms what is called Speculum metal

^ Thus Zinc mixed with Gold renders it whitish, Zinc mixed with Copper forms a yellow metal called Brass

† An increase of the sound seems to be owing to the increase of density by the insinuation of one metal into the pores of another as Bell metal & Ordinance.

= The degree of malleability is always less than the most malleable of the two metals mixed.

mixing of Metals.

All metals may be mixed with each other except Lead with Iron. Metals may all be mixed with Semi Metals except Iron and Mercury. Semimetals may all be mixed with each other except Bismuth & Zinc.

Properties arising from the mixing of Metals are 1st change of Specific Gravity. 2d Change of Structure. 3d degree of Cleish 4th Change of Color. 5th Increase of Sound 6th Loss of Malleability, Gold being so ductile soon looses any impression for that reason Alloy is mixed with our Coin.

Plating of Metals.

Metals are plated 1. by Electrive Attraction e.g. Silver dissolved in the Nitrous Acid & poured on Brass, the Brass absorbs the Acid & the Silver is parted thereto & may afterwards be polished. 2d By Amalgamation as in plating of Tin looking Glasses &c. the amalgam being spread on the Plate and afterwards the Mercury evaporated by a gentle heat sufficient therefor.

Gold is separated from all other Metals by means of Antimony. Gold and Silver may be separated from all other Metals by Cupellation or Calcination w.th Nitre or Amalgamation. Silver from all other Metals except Gold by Cupellation. Gold from Silver by Sulphur. and from such bodies as will dissolve in Aether by means of Aether. Lead & Copper may be separated from each other by means of their diff.t degrees of fusibility.

Section 4th

Of Earths

1st The Natural History of Earths.

Natural History is a very useful science, and the first step to the Knowledge of natural Bodies; this is evident from the superior knowledge we have of natural bodies, since natural history has been pursued with alacrity. Linnaeus has done a great deal this way particularly in Botany. And Zoology or the science of Animals has arrived to great perfection. but the natural history of fossils seems very deficient and is like to remain so, there has not yet been found any way whereby to ascertain proper Classick marks, that being as yet disputed, some reckoning their external mark sufficient for classing them, others

there reckon a chemical Knowledge of Fossils is necessary, for classing of them & this is certainly the surest Method.

Every thing found in the bowels of the Earth has been called fossils, and bones &c: w.ch belong to Animals by lying along time in the Earth may petrify & partake of the nature of a fossil, therefore D.r Hill div.d Fossils into native and extraneous.

Earths may be divided into three classes viz: 1.st Absorbent, 2.d Crystalline and 3. Argillaceous.

Absorbent Earths are known by their uniting with effervescence with Acids, being scarce soluble in Water very brittle and friable,

Crystaline Earths are distinguish'd by their not being soluble in Acids except in

Stony bodies of great hardness, capable of striking fire. - by vehement heat & extinction in water, becoming brittle, friable or powdery: - not acted upon in the least by Acids either in their natural state or when calcined. Neumann

* Earths forming with water a tenaceous paste, or soft stones; - burning hard corroded by strong coction in the mineral Acids, but not acted on by moderate digestion.
Neumann.

* Neumann defines Calcareous Earths — soft stones — reducible by fire into quicklime — readily soluble in the nitrous marine & vegetable Acids, both in their natural state & when calcined. Vide Chemistry. p: 0

in particular cases, made friable in the Fire, found in firm concretions and striking fire with steel. *

Argillaceous Earths are not volatile in Acids, not calcinable in the Fire but acquire a greater degree of hardness. *

obviously tho' it will combine with some of them

These Classes are subdivided into different Genera, but there is no particular marks to distinguish them.

Absorbent Earths from their different properties are divided into 4 Genera viz. 1st Calcareous. 2d Magnesia, 3d Earth of Alum & 4th Earth of Animals obtained by Calcination.

* Calcareous Earths are frequently found in strata & may be reckoned of 3 species viz. Marble, Limestone, and Chalk. Marble is the most pure & homogeneous, it admits of a polish, dissolves in Acids, is of different

Colors

Colors & different degrees of hardness, the hardest is the most pure,

The only Tests of Limestone is, its solubility in Acids, & with water making a good cement, and good to manure Land; it will also sometimes admit of a Polish.

Chalk is distinguished by being friable and admitting of no Polish at all.

Calcareous Earths when they take a crystalline appearance are called Spar &c. are easily broke in Rhomboidal pieces, particles of this kind being absorb'd by the pores of vegetables turn them to petrify as Osteocolla &c.

there is a petrified vegetable grows on a particular Lake in Italy &c. Lake is unfathomable, and in it are many floating Islands formed by an adhesion of matter blown into it and on these fleeting Islands grows this vegetable &c. after a while turns to a stone a piece of this I saw at D.r Morgans.

there is another strange Phanomenon in

× Crystals may be tinged of a variety of colors by exposing in a close crucible to the vapors of Orpiment, or of Antimony and Arsenic, or by quenching the ignited Stones in colord liquors Tinct: of Cochineal gives a bright red, of Saunders a dark red, of Saffron a yellow, a solution of Lacmus a bright blue, Juice of Buckthorn berries a violet blue, a mixture of a solution of Lacmus & a tincture of Saffron a green.

* Precious Stones or Gems are the hardest of all natural bodies. Art has imitated them in other respects, but no artificial composition comes near them in point of hardness

× Crystals are [illegible] & it is by knowing this that Jewelers take flaws out of diamonds without hurting their texture.

In this Lake viz: If aqua fortis is cast into it after some time bubbles will arise w.ch increasing, to a degree of Ebullescence is said will continue for 24 hours.

It is a hard matter to set bounds to the veget.ble & animal kingdoms for Corals have but lately been considered of animal production they having all the parts of a vegetable.

Of Crystaline Earths.

Crystals are pure or impure: the first take in all the precious Stones w.ch according to Mr. Boyle is formed by Crystalization like salt, and Linnæus reckons Crystals, the same & ranks them among salts according to the figure of their crystals, those that are transparent are the purest and all the variety of spots and colors in precious stones is owing to matter taken up during Crystalization. Water may be made solid by filtration, & a crystaline Earth produced.

Glass

Quart is of a milky opaque and is the matrix of most Metals. Flint is semitransparent generally covered with an opake white crust.

The Brazil Pebble has a double refractory power, probably owing to the mode of aggration in its particles. Pebble are mostly composed of strata disposed in a concentric spherical manner.

Sand is either small fragments of crystaline broke off by some means or other, or it consists of particles originally formed so, how D^r. Hill properly enough calls the former Saburra & the latter Arena.

D^r. Hill Divides argillaceous Earths into 3 genera Boles, Marles and Clays, but as the Boles and marls differ only in consistance we choose to follow those who divide them into 2 genera viz: Boles and Clays.

Glass is composed of strata, for if too much Alkali is added the glass will divide like the leaves of a book & all Marbles Diamonds &c. are likewise striated.

Impure Crystals are thin & pasty to other earths in y.m

We may reckon 4 species of this Genus, 1. Quart. 2. Flint 3. Pebbles from the smallest gravel to large stones, & 4th Rockstone of different degrees of hardness from the softest, to Porphyry the hardest.

Argillaceous Earths, are found mostly in an Earthy state of a degree of moistness sufficient to give it some degree of ductility Clays are distinguished by their different degrees of difficibility, Ochre is sometimes found blended with clays as also Sand &c. these make impure, and the purest is the whitest.

Mould partakes of the nature of clay it lies nearer the surface of the ground and is the most proper bed for Vegetation, And now

M^r. Duhamel made some experiments, & even raised several Plants by their suspended in Water alone. Hence it seems that all porous bodies that are capable of imbibing moisture and yielding the same to the growing vegetable is a fit matrix for the same, as a sponge, pressed down in a container or moss.

* By most writers these two have been thought sufficient for vegetation

Now it seems proper to say something on

Agriculture.

Water seems absolutely necessary for Vegetation & perhaps that of itself will furnish sufficient nourishment therefor as seems to appear from several Experiments made on the growth of plants,* however we will examine what soil is most proper for a matrix for Vegetables.

Sand as it is immediately lets the water run thro' it is unfit. Clay as it is of a spungy nature imbibing the moisture seems more suitable, but this is subject to cohesion or being too much moistned, therefore Sand and Clay mixed together seems better as the Sand prevents the Clay from cohering or cementing with Water.* but as the Sand alone is subject to too much vicissitude from the every changes in nature it being sometimes very wet & sometimes dry, there wants

* These may be reduced to three kinds

1st Putrid and putrescent substances whether animal or vegetable.

2d Such substances as will induce a putrefaction in the void as Rain

3d All volatile substances except perhaps Acids

Wants a third substance which will absorb and always retain a sufficient quantity of moisture for vegetation and yield it thereto, and, also keep the Clay pervious at all times. Dung therefore is good to fatten Land having all these properties and all other manures as also calcareous, & putrescent substances, Neutral Salts, Sea salt, Soot &c.

2. Chemical history of Earths.

Calcareous Earths are convertible into Lime and admit of union with all Acids, with the Vitriolic Acid forming the Selenites of which the Gypsums are only different species, while Selenites in equal salt dissolving in water, but from its difficult solution it has been called an Earth it is found in 3 forms 1st In Strata & called Single or foliated Gypsum 2. In fibres called fibrous Gypsum & 3. Irregular.

Wells

With Gypseum the fine stucco work is made, or the curious plaistering.

Calcarious Earths with the Nitrous Acid is mostly found in a deliquescent state & called liquor Calcis, w.ch the muriatic Acid may be obtained in a solid state & is called Fixed Ammoniac the late famed Liquid Shell is made of this fixed Ammoniac & is a good Lithontriptic as well as common Lime Water for Dr. Hales in his Statics found that the human Calculi contains a great quantity of fixed Air, I think therefore the manner in w.ch lime water operates upon the stone is by letting free this mephitic Air w.ch not only lessens the stone but breaks it to pieces and then it is discharged by the Urethra.

Crystaline Earths are used in making Glass & hence called Vitrescent Earths crystaline earths alone are very hard to vitrify but mixed with absorbent Earths they both soon

soon a chief in making of Glass, the Earth should first be well fine & then washed clean from any Acid: then add some Saline substance as Alkali or for common use common Ashes will do or the Lye thereof: in England for making the purest glass they use Calcinated Nitre, the proportion of crystaline Earth to an Alkaline salt should be as 8 to 5. more alkali would make the Glass clearer but then it will be subject to corrosion w.th Acids, and an increased force of fire will answer for want of Alkali.

The Art of Enamseling and imitating Diamonds with Glass depends upon the different substances used therewith.

Argillaceous Earths from their ductility when moist & hardness when burnt depends the Art of Pottery, from the coarser Earthan to Porcelaine.

Earths and Stones are considered by naturalists as two distinct Classes of bodies: and each of them arranged from certain obvious appearances as color, consistance, external figure, texture &c into numerous subdivisions. A chemical examination has discovered, that many of these apparently different bodies are, in their essential properties the same; & that many of those which are apparently similar are essentially very different. Thus the softest Chalk, the hardest marbles & most pellucid Spars, are found to be at bottom one and the same Earth: fire reduces them all to Quicklime, Acids dissolves & forms with them kindred unquitable compounds. And on the other hand the Talcs & Gypsums tho' some of them are externally so alike as to have often been confounded w.th one another and called by the same name;

consists

consists of Earths entirely distinct, for the Gypseum burnt in contact with the Fuel dissolves readily in Acids, whilst the Calces treated in the same manner continues to resist every humid Menstruum.

Stahl rejecting the common insufficient divisions of Earths & Stones by their chemical properties into two Classes viz: Vitrescible and Calcareous.

Neumann reckons there are 4 kinds of Earths distinct from each other, the Gypseous, Calcareous, Argillaceous & Talky to wch may be added a fifth sort of earthy connate with Gypseous.

The Character of the Gypseous Earth & Stones are they are soft, soluble by a moderate fire into an unfixed Calx wch forms wth water a tenacious paste wch by stronger calcination loses that property, not soluble in acid in a natural state, becoming soluble in Acids resembles Quicklime when calcined.

Neumann reckons 5 species 1st Lapis Specularis or Gauies maia 2d Gypsum Striatum 3d Selenites 4th Selenites 5th Bolognastone.

Section 5th

Of Water.

Water as far as we know is only of one specie, it is a heterogeneous substance & distinguished into two kinds 1st Common Water 2d Mineral Water.

Common water we shall say nothing of here.

Mineral Waters has been much talked off of late and have been reckond of many kinds but perhaps, if it was rightly considered they might all be reduc. to a few kinds there being more different degrees of the same matter, than different matters suspended therein we will then a little examin what substances may be suspended in Mineral Waters.

Animal & Vegetable substances from their situation on the surface of the Earth can't be imagined to be in mineral Waters therefore Fossils only are to be suspected and

And 1st Salt Acid Alkaline & neutral
1st Acids the vegetable & nitrous Acids are
scarcely suspected being on the surface of
the Earth, Marga &c may be found the
Nitrous Acid in mineral Waters.

Muriatic Acid is always found
combind making common salt and so
impregnates mineral Waters.

Vitriolic Acid is found in different
fossils & perhaps sometimes seperate &
may thus impregnate mineral Waters
this mostly comes from the Pyrites and has
therefore often other matters with it

2d Alkali, the vegetable Alkali can
not be found in mineral Waters as it is only
found by Calcination and the Alkali of
animals is not found in mineral Waters
Stahl & Hoffman says they found the
fossil Alkali in mineral Waters but it is
mostly

x Selenites in waters that are called hard, as not lathering with Soap because the vitriolic acid decomposes it uniting with it to alkali

mostly united with the muriatic or
Nitrolic Acid. 3d Neutral Salts, there
are two commonly found in mineral Waters
1 Glaubers Salt & 2 Common Salt
2d Inflamables, Naphtha and
Sulphur only in mineral Waters.
3d Metals, Gold & Silver not being
soluble in water nor Acids in the Earth &
therefore not solved in waters & Lead & Tin
but very seldom, Iron and Copper only
dissoluble by Acids in a mineral state are
the only metals in mineral Waters and
Zink and Arsenic among the semimetals
but Iron is the most common of all is is
abounds in greatest plenty in the Earth.
4th Earths, the Calcareous Earth only
found in a natural state suspended in
mineral Waters and the Absorbent Earth
called Magnesia forming Epsom Salt &
Earth of Allum sometimes.

Section 6th

Of Air

Air is that extremely thin fluid that every where surrounds this terraqueous Globe and is of two kinds common or atmospheric and fixed or mephitic Air

The atmospheric Air is the common Medium through which Sounds, Smells & Lights are conveyed, it is absolutely necessary to the preservation of Life & Generation of all things, hence Seneca calls it a necessary part of the Universe. This Air is remarkably elastic, & at the same time an aggregate of many heterogeneous Corpuscles, containing in it the most minute particles of all Bodies, which are mixed with it, fluctuate in it, & are conveyed to it by way of Exhalations, either in a liquid form as in moist Vapors, or in any one by way of Powder or Dust.